# COLLABORATION IN ELEMENTARY SCIENCE TEACHING:

# A CASE STUDY OF TEACHERS' APPRECIATIVE SYSTEMS

by

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# ABSTRACT

This was a naturalistic investigation of the nature of elementary science teaching practice. The main purpose of the study was to portray, through description and comparison of teacher appreciations, how four elementary teachers of science perceived their worlds of practice.

This study was based on the assumption that persons construct their realities and that teachers, as practitioners, also make their worlds of practice. Following Vickers (1983) and Schon (1987), "appreciation" was therefore used as a construct for examining and depicting key features of the teachers' practice. Appreciations of the teachers became the basis for exploring the nature and significance of their collaborative teaching.

Findings of this exploratory study indicate that each teacher had a coherent but distinct set of appreciations of practice which included perceptions of professional identity and of preferences for practice. These appreciations appeared to colour a teacher's "style" of practice and expectations of self and of pupils. While the distinctiveness of a teacher's appreciations suggested that each teacher had a unique style of practice, teachers with similar or differing appreciations of practice engaged in productive, collaborative relationships with colleagues.

Based on their appreciations of practice, teachers in the study seemed to have three major areas of concern and these were related to their instructional services to pupils, unit design and professional self-renewal. It is being suggested in this investigation that teacher collaboration was a strategy used by these teachers to enable them to handle their concerns practicably and efficiently. The implications of these findings are presented in terms of contributions to the practice of teaching and to theory and research on teaching, in particular studies of the "culture" of teaching.

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# CHAPTER 1

# NATURE OF THE STUDY

## 1.0. Introduction

> Practitioners differ from one another... but they also share a common body of explicit, more or less systematized professional knowledge and what Geoffrey Vickers has called an "appreciative system" (Schon, 1987, p. 33).

The problem of this study was to explore and to describe the nature of elementary science teaching practice for certain teaching professionals. It is said that, from a teacher's viewpoint, there are personal (conceptual) as well as practical (contextual) aspects to teaching (Clandinin, 1985; Doyle, 1982). While it is the teacher who is a central figure in teaching, both of these aspects of teaching come into play when a teacher reflects-in-action and makes a world of practice (Schon, 1987). Yet, the nature of teaching practice is such that the personal-conceptual and practical-contextual elements are integrated, not independent (Yinger, 1987).

Both contextual and personal dimensions of teaching can be represented by the construct, appreciation. According to Schon (1987), a person's appreciative system comprises "the set of

values, preferences and norms in terms of which professionals make sense of practice situations, formulate goals and directions for action and determine what constitutes acceptable professional conduct" (p. 33). An appreciation therefore, is considered in this study to indicate an integrated element of an appreciative system which colours the way in which a teaching practitioner understands and deals with practical situations.

Following Vickers (1983), the term, appreciation, embodies the complex interweaving of both "thinking" and "doing" spheres of practice. Hence, teacher appreciative systems and the appreciations of which they are made, have been selected as a means of searching out and describing the dynamic between the personal and the contextual in teaching practice. In this study, the teacher appreciative system has been used as a construct for examining and depicting key features of elementary teachers' science teaching practice.

This has been a naturalistic investigation of how four elementary teachers perceive the reality of their teaching of science, individually and collectively. It is based on assumptions that persons construct their realities and that teachers, as practitioners, also build their own worlds of practice (Goodman, 1984; Schon, 1987).

Four elementary teachers drawn from two different schools

cooperated in this project, the purpose of which was to explore and portray how each of these teachers individually and collectively appreciated their own science teaching. Once a teacher's appreciations of science teaching were identified, one teacher appreciative system could then be compared with that of another. In cases where teachers collaborated with each other in teaching, comparing their appreciative systems revealed the distinctiveness and overlap between their appreciations of science teaching and such information could then be used to gain further insight into the nature of their elementary science teaching practice. By further looking into the character of teachers' collaboration and its significance in their practice, elementary science teaching practice could be portrayed, not only as a practical task but also as a professional endeavour.

In this chapter the perspectives from which the research problem is drawn, are presented. These are the perspectives which have grounded the conceptual framework from which the research questions have emerged.

## 1.1. Background

Three personal perspectives have contributed to the selection and framing of this research problem. They are as follows:

(1) my personal experiences of teaching and teacher

supervision,

(2) my perception that a view of teaching consisting of preactive and interactive components is an inadequate conception of teaching practice, and

(3) my preference for an alternative view of teaching as professional practice, in which "practitioners differ from one other...but they also share a common body of explicit, more or less systematized professional knowledge and what Geoffrey Vickers has called an 'appreciative system'" (Schon, 1987, p. 33).

In the following discussion, each perspective is briefly reviewed in order to indicate how it has contributed to the background for the research problem.

## 1.2. Experiential Perspective

For about ten years I have taught various subjects in elementary and secondary schools from grades one to twelve. In the last four years or so, I have supervised student teachers. Because of my own experience and knowledge of teaching, I hoped that I could assist novice teachers to prepare themselves for classroom teaching. My primary method of coaching these novices was based on a variant of Goldhammer's (1980) model of clinical supervision.

During many hours spent in classrooms with experienced cooperating teachers and beginning student teachers, there has been ample opportunity to compare the ways of the "expert" with the ways of the "novice". It appeared that experienced teachers seemed well able to "think on their feet". In so doing, they appeared to initiate practices that were successful in their classroom contexts. Observations of such expert and novice cases were shared with student teachers and used as points of discussion or in role plays. The intent was that, through these exemplars and a comparison of them with personal field experiences, novice teachers could be prompted to consider and implement options for teaching, which were not immediately obvious to their own inexperienced eyes.

Many of these students are now practising classroom teachers. Despite their "good grades", it is difficult for me to tell whether the brief coaching they received from me in seminars and practica was influential in changing the nature of their teaching practice to any considerable extent.

Teacher supervision is challenging and enjoyable but the ambiguous nature of the faculty supervisor's role can be discomfiting for student teachers and for faculty. There is no "rule book" or "prescribed bedside manner" for teachers or teacher supervisors. Integrating the theory and practice of teaching is

necessary, but using current research on teaching with beginning teachers is not easy. It involves helping novices to sift out relevant and useable aspects of research and to recognize when and how to apply these to instances they face in their own practice. It seemed that the more teaching experience a student teacher got, the easier it was for that student to reflect on and come up with viable alternatives for use in practice. However, my position as faculty advisor required that I fluctuate between the "knowing-in-action characteristic of competent practitioners in a professional field" and the form of professional knowledge disseminated at a faculty of education (Schon, 1987, p. 40). Seeing myself as a practitioner therefore lent even more ambiguity to my role.

Cooperating teachers display a kind of "know-how" of teaching that novices do not have or come by easily. It is almost as though many years of teaching have enabled teachers to carry in their heads, so to speak, a mixed bag of knowledge, techniques, perceptions and "gut feelings" about teaching. These appreciations of teaching would emerge with ease at the appropriate moments in the classroom. Such on-the-spot expertise, student teachers do not usually have.

As a supervisor, I felt that it should be possible to reveal to beginning teachers some of the many elements of this "smorgasbord" of expertise that experienced teachers hold, in

order to help novices identify and try out what might suit their own practical teaching circumstances. With guidance, student teachers could then, over time, transform these selected exemplars of practice into integral parts of their own professional repertoire. As a supervisor, my dilemma was finding ways to enable any student to recognize which aspects of these practical cases could be formative for that particular student, at that point of professional development.

The nature of the knowledge communicated to student teachers in faculties of education is of a particular kind (Lortie, 1975). Traditionally, professional training has been technically oriented (Turner, 1975; Beyer & Zeichner, 1982). For instance, teachers in training are encouraged by faculty to concentrate on techniques such as writing "good" lesson plans (Tabachnick, Popkewitz & Zeichner, 1980). Yet, these plans, often based on sound theoretical notions, rarely seem to "work out" in the classroom as planned. "Technique was treated [by teacher training faculty] as an end in itself and not as a means to some specified educational purpose or goal" (Tabachnick et al, 1980, p. 22). Are student teachers placed in a situation of conflict when they have to negotiate between a university-based professional school and experienced practitioners in the field?

The knowledge of teaching that novice teachers receive in training implies that, in practice, teaching is a two-step

process, with a preactive planning phase followed by an interactive mode. In other words, first a teacher thinks and plans; then a teacher works according to the plan. However, competent practitioners seem to think that novices need field experiences to develop practical skill (Lortie, 1975). Novice teachers in the field have to cope with a dynamic complexity of teaching practice which is not necessarily compatible with a technical, university-based conception of teaching (Spencer-Hall, 1982). A close look at how experienced teachers work in class would be needed to see what they do and to explore how they reflect on their practice in order to change it. This sort of information could ultimately provide a practical knowledge base of teaching that might be of use to teacher educators as well as to student teachers.

## 1.3. Research-based Perspective

### 1.3.1. A Technical View of Teaching

Several studies of teacher thinking have treated teaching as a dichotomous activity with a preactive, planning phase and an interactive phase in the classroom (Borko & Shavelson, 1983; Doyle, 1982; Marx & Clark, 1978; McCutcheon, 1981; Morine, 1976; Zahorik, 1975). While this dichotomy may be a useful methodological and analytical device, it has limited applicability for those who are practitioners in the classroom.

Findings of some preactive teacher thinking studies are not consistent with the pattern of findings for certain studies of interactive teaching. For instance in their summary, Borko and Shavelson (1983) say that the interactive phase of teaching seems to function for teachers mainly to implement previously designed tasks. In front of the class, teachers seem to make few decisions. These are impetuously made, in response to unanticipated events. On the other hand, in preactive planning, teachers appear to be prolific thinkers, deliberate and creative in their thinking, willing to select certain tasks and juggle a number of goals to achieve a "reasonable" balance for instruction.

The quality of teacher thinking implied by each set of findings is different and therefore confusing. Together, these findings may present a disjointed picture of teacher cognition. Practitioners who are reported as being creative, preactively, appear to be somewhat deficient in their thinking interactively (McCutcheon, 1981; Borko & Shavelson, 1983).

What could account for such inconsistency in the quality and substance of teacher thinking before and during instruction? Should the same purposefulness and rationality of the preactive thinker not be evident in interactive teaching practice? Or, are those findings an artifact of looking at teaching in two discrete phases; one of thinking and one of doing. If so, is it really

appropriate to view the practice of teaching as a dichotomous process? Such a conception may not adequately account for the "artistry" which practitioners are said to display when they operate in practice (Elbaz, 1983; Dillard, 1987; Yinger, 1987). Another view of teaching might allow for a conception of teaching practice as a whole with many integrated elements.

## 1.4. Conceptual Perspective

### 1.4.1. Teaching as Professional Practice

In an analysis of the work of various professionals, Schon (1983, 1987) claims that professional practice is indeed marked by complexity and spontaneity. Yet, he argues, the professions and professional schools through which this knowledge is conveyed, still remain entrenched in a "positivist view of knowledge". The formal knowledge of professional schools is rigid and unyielding to the nuance and uncertainty of the practitioner's world. It does not allow for the "spontaneity and complexity" that Schon ascribes to practitioners in action. But, the accepted traditional, "technical rational" doctrine of professional knowledge, to which Schon refers, is so firmly embedded in academic culture that it has shaped even how the professions are conceived.

Technical rationality seems prevalent in faculties of education and also in research on teaching. A natural consequence

of the technical rational view of professional knowledge is that professional schools seek to package and deliver professional knowledge as though it were precise skills and techniques. Consequently, practitioners, who see their work in the field as "experience, trial and error, intuition and muddling through," come to think that their ways are inferior. For Schon (1983), this situation calls for a new epistemology of practice, one that is more applicable to the reality of practice.

### 1.4.2. Teachers as Practitioners

Schon's descriptions of professionals-in-action imply that there is merit in thinking of teachers as practitioners. A position such as Schon's enables teaching itself to be viewed as practice, "chunks of activity, divisible into more or less familiar types, each of which is seen as calling for the exercise of a certain kind of knowledge" (Schon, 1987, p. 33). With this proviso, teaching practice can be seen to be one complex but holistic arena of operation with various features.

To think of teaching as though it were a preactive-interactive process is a remnant of the technical-rational perspective of professional knowledge. I wish to argue in this dissertation that it is important to provide an alternative conceptualization of teaching, one which focuses on the creative, insightful routines of teaching practice.

### 1.4.3. Practice as Reflection-in-Action

According to Schon (1983), reflection-in-action is the mechanism by which professionals construct their practical reality. When practising professionals appear to respond intuitively to practical problems, their response is not as automatic as it seems. The activity of the moment causes the practitioner to reflect back upon previous similar happenings and intuitive understandings of "new" situations surface. These are then interpreted and re-interpreted to fit existing circumstances. This process of determining what is a problem in practice and inventing a solution, "on the spot" is called by Schon, reflection-in-action. He explains further that:

> When someone reflects-in-action, he becomes a researcher in the practice context. He is not dependent on the categories of theory and technique but constructs a new theory of the unique case....He does not keep means and ends separate, but defines them interactively as he frames a problematic situation. He does not separate thinking from doing, ratiocinating his way to a decision which he must later convert to action. Because his experimenting is a kind of action, implementation is built into his inquiry (Schon, 1983; p. 68).

### 1.4.4. Teachers as Reflective Practitioners

Just as reflection-in-action is prevalent in the practice of architects and engineers, so too it is a part of teaching practice (Schon, 1983). Through reflection-in-action, teachers come to see

new classroom events in the light of previous experiences with which they have dealt. There is a constant stream of unpredictable moments in a teacher's practice and so a teacher builds a repertoire of dealings-in-practice within which the uniqueness of each case is crucial; predesigned plans need not apply.

Schon (1987) has given much attention to analyzing exemplars of reflective practice of professionals other than teachers. In view of the discrepant findings of a preactive-interactive model of teaching, it may be worthwhile to examine teaching practice from the viewpoint of the teacher as a practitioner. Schon's theory of reflection-in-action provides for a conception of practice that presupposes another kind of link between thinking and doing in teaching practice--one other than that implied by a preactive-interactive view. Classroom teaching need no longer be considered merely responding to a preordained plan. Instead, reflection-in-action supports a view of practice in which the elements of teacher thinking and doing in teaching practice are created but they are integrated and not merely a consequential, "means-ends" dichotomy.

If teachers think-in-action in classrooms and experiment in their teaching within a classroom context, it would be useful to know how they describe the motions they go through. Indeed, such a study may contribute to the knowledge of teaching practice, by elaborating on how practitioners see their own work.

### 1.4.5. Appreciative Systems as a Representation of Practical Worlds

Reflection-in-action is considered a mechanism by which professionals construct their (practical) worlds (Kelly, 1955; Goodman, 1984). A basis of this construction is the practitioner's own appreciative system (Vickers, 1983; Schon, 1983). An appreciative system is defined as a "set of values, preferences and norms in terms of which professionals make sense of practice situations, formulate goals and directions for action and determine what constitutes acceptable professional conduct" (Schon, 1987, p. 33).

Therefore, one way of representing the related set of views which direct a teacher's practice is by means of an appreciative system. Teachers' appreciative systems are used in this study as a conceptual device for capturing and representing teachers' ideas on their worlds of practice. For ease of expression, the elements of a teacher appreciative system are described in this dissertation as teacher appreciations. Whether or how these function as "norms" or "values" is not important to the particular aims of this study. What is crucial is that a teacher appreciative system incorporates elements of constructing, reconstructing and reacting to a situation of practice, which do not imply that a teacher operates mainly by applying a preconceived plan.

## 1.5. Summary of Perspectives

The three perspectives discussed above have contributed to the way in which the research problem has been framed for inquiry. To indicate their relevance to the research problem, they are summarized here.

Personal Experience: The nature of teaching practice for novices is different from that of their experienced, cooperating teachers. Experienced practitioners seem to construct their practice in action and so, changing the practice of novice teachers appears to involve much "learning by doing". But, the prevalent epistemology of practice in faculties of education takes limited account of such a position. There is need to find out more about the intuitive ways in which experienced practitioners generate their practice. This sort of information would be of use to those who prepare beginning teachers.

Research on Teaching: Teaching has often been described in the research literature as a thinking-doing or preactive-interactive process. Such a dichotomy relegates much of what constitutes teaching to a "non-thinking" interactive mode and teachers to the status of simple doers and relatively passive thinkers. There

ought to be a reasonable alternative to such a position, one that may well be based upon another view of what constitutes teaching practice.

Teaching as Practice: Teaching can be viewed as professional practice. What occurs in teaching is not unlike what happens in the practice of other professionals. Teachers are practitioners. They construct their own practical reality. In order to find out more about the nature of teaching, it is important to explore how teachers represent the worlds of practice they construct.

The previous summary has attempted to present the perspectives which have contributed to the manner in which the research problem has been framed for study. The following discussion relates these perspectives to the concepts used to frame research questions for this investigation.

## 1.6. Research Problem

### 1.6.1. Overview

Teachers are professionals but they are also practitioners. The world of teaching is a complex, interwoven net of the personal (conceptual) dimensions of teaching coming from the teachers themselves, as well as the contextual (practical) demands of the job with which teachers must routinely deal.

As practitioners, teachers are continually engaged in thinking and re-thinking their views and experiences of practice. This is done through reflection-in-action which is often spontaneous and intuitive. Reflection is a means by which the teaching practitioner can express professional commitment and refine strategies for handling perceived contingencies of the job. Thus, teaching practice can be viewed as a spontaneous, dynamic, intuitive experimenting by teachers, in practical situations (Schon, 1983).

A basis of practical reflection-in-action is the teacher's appreciative system. Appreciative systems resonate between the personal and the contextual in teaching practice. Hence, teacher appreciative systems are being used in this inquiry as a lens through which to view teachers' construction of their worlds of practice from their perceptions of themselves and their settings. The elements that make up a teacher appreciative system are called appreciations and the term, appreciation, is itself used to represent the integration of elements of thinking and doing that may be said to characterize professional practice.

### 1.6.2. Problem Statement

The overall purpose of the study was to explore and articulate how four elementary teachers appreciated their individual worlds of practice and to find out the extent to which these appreciations

were shared by the teachers with whom they chose to collaborate in teaching science. Specifically, this inquiry investigated the nature and comparability of four elementary teacher appreciative systems of science teaching practice. Out of these purposes stemmed three sets of questions for research.

1.6.3. Research Questions

The first set of questions deals with how teachers appreciate their own practice and what these appreciations appear to be:

(1) How do elementary teachers describe their own practice of teaching science? More specifically,

(a) What appreciations of their identity as practitioners do teachers of elementary science hold?

(b) What preferences for the practice of elementary science teaching do these teachers seem to have?

The second group of questions explores the extent to which features of teacher appreciative systems are shared by other practitioners.

(2) Given that teachers have appreciative systems of practice, how does the appreciative system of

one teacher compare with that of another teacher?

(a) What common features and what differences exist between the professional identity and practical preferences of teachers who collaborate in their teaching of elementary science?

(b) For the teachers who collaborate in the teaching of elementary science, what is the nature of the collaborative relationships they share?

The final question of the study directly addresses a major purpose of this inquiry:

(3) In view of the nature and comparability of these teacher appreciative systems, what major concerns about their science teaching do teachers have and what is the significance of teacher collaboration in their handling of these concerns?

1.6.4. Context

The major intent of this study was to explore how elementary teachers viewed their world of science teaching. Teacher appreciative systems were used as a conceptual device with which to search out and represent teachers' ideas about their science

teaching practice.

Four teachers participated in this investigation. They came from two elementary schools, located a few kilometers from each other, within a large urban district in the Lower Mainland of British Columbia. Two teachers taught the primary grades and two taught the intermediate grades. Data were gathered on one unit of science instruction for each teacher.

## 1.7. Significance of the Study

The ultimate goal of the study was to examine and document the way that teachers seemed to approach the teaching of elementary science. This was done by examining and describing how experienced teachers appreciated aspects of their practice. Since teachers were being viewed as practitioners, it was important to obtain their own insights of their work in classrooms and to try to picture how they see their own practice. In so doing, the study has significance in terms of its potential to contribute to a better understanding of practice as well as theory.

### 1.7.1. Contributions to Practice

There was merit in dealing with this type of problem because it was an attempt to:

(a) engage teachers in reflections and discourse on their practice, a task which, though difficult, has the potential to be of benefit to them as professionals.

(b) uncover the basis of how teachers represent to themselves and resolve practical situations--information which supervisors of teachers may find useful.

(c) articulate case knowledge about the teaching of science which other practitioners may find interesting.

More importantly, the general problem relates to teachers' professional experiences and practices. Discussions of this nature could be of interest and value to other practitioners.

1.7.2. Contributions to Theory

By attempting to probe "inside teachers' heads", so to speak, and see the extent to which individual appreciative systems of practice are shared by other teachers, this study should contribute to a relatively new field of research on the cultures of teaching (Feiman-Nemser & Floden, 1986). Any insights gained here may be of use in future investigations on the theory of the culture of teaching.

Also, this enquiry is based on a constructionist perspective

of how individuals "see" their world and how this vision shapes and colours what they do (Schon, 1987). Some researchers of teacher thinking recommend that research efforts be directed to constructing a "taxonomy of critical teaching decisions" (Shavelson & Stern, 1981). Others point to the need for a new epistemology of practice (Erickson, 1987). In order to accomplish such ambitious, but diffuse, goals, an initial step is required. It is necessary to find out how aspects of the practical contexts of teaching interact with and relate to teachers' thinking-in-practice. This study has identified teacher appreciations and these have spelled out how teachers viewed their practice. To that extent, these findings have the potential to enhance current work on the theory of teacher cognition.

## 1.8. Limitations

This study has the following limitations:

(1) Only elementary science teaching was looked at. Interviews and observations of teachers occurred only in their science classes over one unit. No data were gathered on the teaching of other subjects.

(2) For the purposes of this study, teaching and learning were taken to be separate. The study dealt only with issues of teaching practice and teachers were considered to be the ones who build

their own practice. No obvious attempts were made to focus on pupil learning, except to the extent that pupils were operative elements in each teacher's practice.

(3) Though derived from a limited set of data, the classes observed, the interviews conducted and the appreciations drawn from these data sources were considered typical of the teachers who participated in this study.

(4) The concerns that have given rise to this research problem have come out of the researcher's own practical experiences as a teacher and a teacher of teachers. It is inevitable that this subjective stance would colour the intents, methods and findings of the study.

(5) This is an exploratory investigation of practice, with a small select sample. Caution must be exercized in generalizing these findings to other practical situations.

The most recent edition of the Handbook of Research on Teaching (1986) contains a new chapter on the cultures of teaching. The authors claim that there are few of these studies and that they are not easy to do because certain problems are endemic to this type of inquiry:

> The problem of making inferences about beliefs and knowledge was one factor that led to the flight from

> behaviorism. While the benefits of behaviorism proved too costly, the complexities of cognitive research have not vanished. Research on the culture of teaching is labour intensive.... Even well-supported studies can seldom go beyond a small sample of teachers. The variation in teaching cultures limits the generality of conclusions from any one study (Feiman-Nemser & Floden, p. 523).

This exploration of teachers' practical worlds is not exempt from any of the limits identified above by these authors.

## 1.9. Organization of the Dissertation

This dissertation contains seven chapters. In the first chapter the perspectives that form a backdrop for the general research problem and the way in which they frame the specific research questions are discussed. This is followed by a review of selected theories and research studies, which substantiate and extend the position outlined in the first chapter, from which the research questions originated. In Chapter 3 the procedures for gathering and analyzing the data are presented. Then there are three chapters of findings, Chapters 4, 5, and 6, each representing a progressively more descriptive/interpretive response to each of the three major research questions posed in Chapter 1. The final chapter contains an overview of the purposes of the study, with implications for a few broader issues of the theory and the practice of teaching, which have emerged from a study of these particular cases of elementary science teaching.

## 1.10. Definitions

Appreciative System: According to Schon (1987, p. 33), "the set of values, preferences and norms in terms of which professionals make sense of practice situations, formulate goals and directions for action and determine what constitutes acceptable professional conduct". In this study, an appreciative system represented a coherent collection of teacher appreciations of elementary science teaching practice. Emphasis has been placed on characterizing teachers' appreciations of their identities as practitioners and their preferences for science teaching practice, as opposed to "values" or "norms".

Appreciation: an integrated element of an appreciative system that permits a teacher to understand or rethink while reacting to a practical situation (after Schon, 1987).

Collaboration: the particular form of practice and the professional relationships which emerge when two teachers choose to share their expertise and practice while they teach elementary science, still maintaining the integrity of their own classrooms.

Content: the subject matter of science as taught in the units of science instruction included in this study.

Interactive: commonly used to refer to the phase of teaching in class when pupils are present and the teacher interacts with them to deliver the content.

Practitioner: one for whom practice is central to the work of the profession.

Preactive: commonly regarded as the planning phase of teaching which occurs before the teacher's actual interaction with pupils in class.

Reflection-in-action: spontaneous, intuitive experimenting which occurs in practice (after Schon, 1983).

Teaching Practice: "made up of chunks of activity, divisible into more or less familiar types, each of which is seen as calling for the exercise of a certain kind of knowledge" (after Schon, 1987, p. 3).

# CHAPTER 2

# REVIEW OF THE LITERATURE

## 2.0. Overview

In the previous chapter, the purposes of this study were stated to be an examination and comparison of four teachers' appreciations of their worlds of practice, with the intent of understanding how these teachers construe their practice. These specific aims are, however, linked to broader perspectives of the way in which individuals perceive and respond to experiences in their worlds. For instance, to investigate how teachers see and make their worlds of practice, it would be useful to refer to the manner in which other persons make their worlds. The intents of this project then, generally relate to the subject of worldmaking (Goodman, 1972; 1984). Presumably, the nature of the worldmaking processes of others can shed light on the way that teachers appreciate their own practice. As background to this inquiry, the following aspects of literature have been examined:

(a) cognitive perspectives of teachers' worlds,

(b) practical perspectives of teachers' worlds,

(c) the general nature of worldmaking and its implications for investigating teachers' worldmaking.

Selected findings of recent studies on these three topics will be presented in this chapter. These findings will illustrate the relative importance of what is known about the cognitive and practical dimensions of teachers' worlds from these studies as well as from a consideration of the way in which persons are generally said to "make" their worlds.

## 2.1. Cognitive Perspectives of Teachers' Worlds

### 2.1.1. Introduction

Much of what is known about the worlds of teaching practitioners comes not only from research on teaching but also, to some extent, from studies of schooling which form a body of literature that has evolved considerably in the last decade (Shulman, 1986). The studies which are the focus of this review are those which have delved into the practical aspects of teaching, in particular those which have examined practitioners' viewpoints about their own classroom teaching. Selected studies will be discussed in this section to provide insights into the shape of the world of teaching practice and into the manner in which teachers have personally viewed their business of teaching.

### 2.1.2. Trends in Research on Teaching

Teaching is about knowledge and communicating knowledge. Traditionally, studies of teaching have sought to link identifiable teacher attributes to measureable educational outcomes. This process-product orientation implied that changing teaching outcomes or improving quality of teaching was simply a matter of specifying appropriate changes in teacher behaviour (Gage, 1978). This view, however, cannot adequately define or explain all that is involved in teaching. A most important indicator of what is learned has been shown to be the classroom teacher (Peterson, Marx & Clark, 1978).

From a different angle, studies of curriculum implementation have indicated that teachers are resistant to using in class ideas that are innovative when they are developed externally (Fullan & Pomfret, 1977). In practice, teachers seem unwilling or unable to produce consistently on demand, the actions prescribed for certain curricular outcomes (Gage, 1963). Other researchers have not readily accepted arguments of teacher deficiency and have sought to explain perceptual differences between teachers and curriculum developers from alternative perspectives (Smith & Sandelbach, 1979). Variants of this type of research on teaching have recently emerged. Yet, a number of these studies seem to develop progressively less of a focus on the effectiveness of teaching and

more of a desire to look into the texture of classroom life, as well as the cognitive processes of teachers and of students (Jackson, 1968; Flanders, 1970; Dunkin & Biddle, 1974; Good, Biddle & Brophy, 1975; Doyle, 1983; Mackay & Marland, 1978; Winne & Marx, 1982). Such research efforts have provided avenues for looking in-depth into the way teachers think about their teaching and how they actively cope with the practical demands of their work (Elbaz, 1983; Shavelson, 1983).

The result has been a new genre of research on teaching based on starting points and methods, which concentrate on description of teaching more than on prescription for teaching. Among these are studies of teacher thinking, most of which seem to draw on elements of cognitive psychology. This newer research agenda base on teaching as cognition acknowledges the inherent intricacies of the teaching process and supports the need for closer examination of teaching, as it is viewed and experienced by practising teachers (Clark & Peterson, 1986). Instead of paying attention to identifying teacher behaviour, close scrutiny of the mental structures of individual teachers is done. This assumes that the process and content of teacher thought play a role in the way teachers teach and that knowing something of how teachers think and feel could contribute worthwhile information about teaching itself (Peterson, Marx & Clark, 1978; Conners, 1978; Munby, 1983).

While it has been productive to look at teacher cognition,

examining cognitive dimensions of teaching has been quite a different research venture from experimental investigation of teacher performance. Clark and Peterson (1986) in Chapter 9 of the Handbook of Research on Teaching point out that:

> Because this research is so new, each study seems to break new ground... Researchers have also tended to focus on relatively discrete and isolated aspects of teachers' thoughts and actions, rather than on the whole process of teaching... the time seems right for more comprehensive study of the full variety of teachers' thought processes in relationship to teachers' actions and their effects on students... researchers would do well to work simultaneously on descriptive models of teacher thought processes and on descriptive models of the tasks of teaching (p. 292).

The research problem, assumptions and methods of this study are not congruent with the process-product position which encouraged a focus on teacher behaviours. The questions of this inquiry have emerged from concerns about the "whole process of teaching". They are questions about the interplay between personal (conceptual) aspects of teaching and contextual (practical) features of teaching. Such concerns acknowledge and support a view of teachers as thoughtful professionals who bring some degree of reflection, metaphorical expressions of practical knowledge and personal beliefs to their practice (Olson, 1981; Munby, 1983; 1987; Morine-Dershimer, 1987). This stance also recognizes that reflection is a critical ingredient of teaching and that reflection in teaching is somehow related to "indeterminate zones of [teaching] practice" (Schon, 1983; Erickson, 1987, Grimmett et

al, 1987; Russell, 1987).

Acknowledging that reflection can play a role in teaching allows for exploration of both professional and personal dimensions in teaching, be they cognitively or practically oriented. Details of actual findings of selected studies on teaching practice are presented in Tables 2.1. and 2.2. as a convenient summary of those aspects of the literature which are relevant to this research problem. The contents of these tables are meant to give some indication of salient features of teachers' worlds of practice and, accordingly, to act as referents for the ensuing discussion in which specific findings from these tables are examined, in the light of the research questions of this study.

### 2.1.3. Preactive Thinking and Planning

Research on teacher thinking supplies many insights into the nature of teaching practice. Work on teacher thinking has followed a trend to conceptualize teaching as a process with discrete phases of preactive and interactive activity (Jackson, 1968). With this prototype, in the last decade, researchers have tried to reconstruct how teachers think, often modelling what teachers do on information processing and classifying teachers' information processing abilities as decision making or problem solving (Newell & Simon, 1972; Shavelson, 1976). This literature indicates that

Table 2.1: Cognitive Aspects of Teachers' Worlds

## Preactive Thinking and Planning

### Thinking

- teachers have beliefs, principles, personal interpretations, conceptual systems and perspectives which undergird their teaching (Marland, 1977; Conners, 1978; Duffy, 1977)
- orienting beliefs of teachers relate to (a) prioritizing curriculum demands (b) taking account of pupil needs (c) fostering pupil choice (d) promoting social interaction (Bussis, Chittenden & Amarel, 1976)

### Planning

- conscious choices; long term and short term: by lesson, unit, day, week, month, term and year, (Yinger, 1977)

### Use of Planning

- mechanics of curriculum transformation; establish and maintain work routines; match teaching activities with available time (Yinger, 1977; Clark & Yinger, 1980)

### Planning Process

- more directly connects to determining content and activities than to specifying objectives (Zahorik, 1975; Peterson, Marx & Clark, 1978)
- interrelated with experience and knowledge (Yinger, 1977)
- mental imagery; often not completely written out but barely outlined on paper (McCutcheon, 1981)
- composed of essential "lesson images" on how or what to teach
- plans readily relinquished in case of in-class disruption (Morine, 1976)
- in science, heavily influenced by teachers' guides and planning images rigidly adhered to (Smith & Sandelbach, 1979)

## Academic Work and Interactive Thinking

### Academic Work

- shaped by "ecology" of classroom
- pupils develop coping mechanisms which affect what constitutes academic work
- teachers use "preferred practices". (Doyle, 1982)

### Interactive Thinking

- spontaneous, "off-the cuff" decision making
- less deliberative (Shavelson & Stern, 1981)

### Process of Interactive Thinking

- essentially weighing alternatives in response to unanticipated events
- large proportion of thought on learner abilities, content, teaching strategies; much less to objectives (Marland, 1977; Conners, 1978; Marx & Peterson, 1981)
- resorting to "routines" to simplify uncertainty and ambiguity (Smith and Sandelbach, 1979)
- heavily driven by considerations of pupils such as, compensation, lenience, power sharing, progress checking, less thought to content (Marland, 1977)
- shaped by (a) professional principles: suppressing emotions, teacher authenticity and (b) pedagogical principles: cognitive linking, integration, closure, general involvement, equality of treatment (Conners, 1978)

teaching is a complex mental activity, with teachers operating as deliberate and rational thinkers (Halkes & Olson, 1984).

After Jackson (1968), research on teacher thinking has been classed into studies of preactive teaching and studies of interactive teaching. The former dwell on how teachers think and prepare for teaching, more or less in the planning or preactive phase of teaching. The latter focus on what actually occurs during classroom interaction, the interactive phase. The preactive phase of teaching has been considered distinct from the interactive phase and has, until recently, tended to be investigated separately (Shavelson, 1983). Knowledge of either phase contributes to knowledge about worlds of teaching practice.

It appears that in the preactive phase of teaching, teachers are problem solvers. They are said to use problem solving to define and elaborate their mental plans and activities for a lesson. Findings in Table 2.1. indicate that these plans are used to set the stage, so to speak, for the actual lesson (Zahorik, 1975; Morine, 1976; Yinger, 1980; McCutcheon, 1981). The basic unit on which teachers build their mental plans is said to be the "task" and out of tasks come teachers' goals for instruction. In the course of generating mental plans, teachers seem to juggle multiple goals in order to achieve "a reasonable balance" for instruction. Some teachers appear to concentrate exclusively on the subject matter of instruction; others appear to use the

subject mainly as a channel for attaining their own "motivational goals" (Borko & Shavelson, 1983).

### 2.1.4. Academic Work and Interactive Thinking

Quite a different picture of teacher cognition appears to obtain in the study of actual teaching practice, when the teacher is in face-to-face contact with pupils in class. By analyzing teaching as it occurs on-the-spot in class and focussing exclusively on the tasks of academic work, Doyle (1982) has examined the academic tasks of teaching, from a pupil's viewpoint; not from a teacher's perspective. His findings are interesting.

Academic work, he says, is shaped by the complex ecology of the classroom setting. Both teachers and pupils develop and use interactively, systems for coping in class which colour what passes for academic work in class. Doyle's (1977, 1982) findings imply that the plans and activities which teachers construct before going into class are not played out in class, as conceived. Students develop their own systems of viewing and coping with teachers' academic task demands. While Doyle's work has identified the complex nature of pupil involvement in instruction, it has not dealt with teachers' parallel perceptions of their own classroom lives.

Studies of interactive teaching summarized in Table 2.1 also

indicate that in class, teachers are cognitively active as decision makers. They are driven to implement well-formulated preactively conceived plans but, they experience some difficulty in so doing (MacKay & Marland, 1978; Peterson, Marx & Clark, 1978). Decisions made in class are shaped by teachers' perceptions of their pupils, the content and strategies of teaching, their own professional principles and to a limited extent by objectives for teaching (Marland, 1977; Conners, 1978). These findings raise questions about how teachers view their work and the nature of their motives for operating as they do. Why would experienced practitioners make plans that they intend to disregard in class? Similarly, why would experienced teachers fail to recognize and accommodate the uncertain features of practice which they perceive to characterize their workworlds?

Though selective in its focus, research on teacher thinking has been innovative and significant. This knowledge of teachers' mental processes has served to emphasize the ambience of teaching and its complexity. It is true that teachers engage in different sorts of activities before and during instruction. But, to say with Shavelson (1983), that "teachers' behaviour is guided by their thoughts, judgements and decisions" and to ground this assertion in a limited preactive-interactive model of teaching, is to posit a linear, consequential relationship between thought and action in teaching, which excludes the dynamics of the practical context of teaching. In a major review of the literature, it has

been said that models of interactive decision making have two major drawbacks (Clark & Peterson, 1986). First, teachers' in-class choices should also be considered to be deliberate, not merely responsive. Second, it is important to indicate antecedents of teachers' interactive choice making, other than the students in their classes.

Indeed, as it is with other professionals, teachers' perceptions must also contribute to their instructional choices (Schon, 1983; Benner, 1984). One can then speculate that the press of the classroom environment may have the potential to dominate teacher thinking and to influence the quality and process of teacher thinking throughout teaching. In the face of evidence of a reflexive, improvisational, practical world of teaching, this would not be an untenable position to hold (Elbaz, 1983; Dillard, 1987; Yinger, 1987).

Studies of teachers' practical knowledge and their professional practice, also shed some light on the nature of teachers' worlds. These findings are summarized in Table 2.2. and they will be discussed below, as they too add form to the picture of the world of a teaching practitioner.

Table 2.2: Practical Perspectives of Teachers' Worlds

PRACTICAL KNOWLEDGE

TYPE

- rules, principles of practice and images of practice (Elbaz, 1981)

CONTENT

curriculum, subject matter, instruction, setting, self (Elbaz, 1981)

ORIENTATION

- situational, social, personal, experiential, theoretical
- teachers have and use practical knowledge which emerges from their intuitive blending of reflections, experiences and images of instruction within milieu of operation (Elbaz, 1981; 1983)
- teacher practical knowledge is a special, person-centred, blend of theoretical and practical kinds of knowing expressed through the particular context of teaching (Elbaz, 1983)
- "embodied images" such as, "classroom as home" have moral and emotional dimensions that are expressed through teaching practice (Clandinin, 1985)

PROFESSIONAL KNOWLEDGE

- four types of conceptions of professional practice prevalent among teachers:
  (a) the more experienced a teacher is, the more that teacher attends to pupil thinking rather than to teacher planning
  (b) knowledge of teaching is cumulative and developmental, much like learning by "trial and error"
  (c) with time, teachers move from a focus on teaching of facts to the teaching of principles
  (d) in time, teacher's work becomes increasingly routinized (Larsson, 1987)

PROFESSIONAL KNOWLEDGE (contd.)

- teachers have a **language of of practice**: "a set of integrated patterns of thought and action", which is responsive to and dependent on teaching context, holistic, personally-oriented and grounded in common sense, experience and practical reasoning (Elbaz, 1983; Lampert, 1985; Clandinin, 1986; Oberg, 1987; Yinger, 1987)

- successful teaching calls for "of-the-moment" responses to class -- **improvisation**
- skill in teaching can be linked more closely to the existence and use of teacher improvisational technique than to decision making models which imply adherence to predesigned courses of action (Dillard, 1986; 1987; Yinger, 1987)
- in the teaching of math and science, teachers' content knowledge, classroom organizational knowledge and knowledge of pupils' preconceptions, and teachers' beliefs about the nature of science teaching were critical ingredients of their practice (Smith & Neale, 1987; Peterson et al, 1987; Carpenter et al, 1987)
- in math classes, teacher's attempt to devise "social structures" so that they can take account of the quality of pupils' thinking about the subject, even though these structures often compete in class with other "person-directed superscripts" which guide teaching practice (Lampert, 1987)

## 2.2. Practical Perspectives of Teachers' Worlds

### 2.2.1. Practical Knowledge

Elbaz (1983) has done a detailed examination of the world of one teacher. She argues that teachers have and hold practical knowledge. This is described as a kind of knowledge which includes, "first hand experience of students' learning styles, interests, needs, strengths and difficulties, and a repertoire of instructional techniques and classroom management skills, ... the social structure of the school and what it requires, ... the community of which the school is part, ... informed by the teacher's theoretical knowledge of subject matter..." (p. 5). According to Elbaz, there are three major forms of practical knowledge. They are rules of practice, principles of practice and images, all of which are used by teachers to make and give meaning to their practice.

It would seem that the knowledge which teachers use in practice is comprehensive. It embraces dimensions of experience as well as practical and pedagogical expertise, all embedded in teachers' perceptions of the context. As such, the practical knowledge of teachers is complex but coherent, "a contextually relative exercise of capacities for imaginatively ordering our experience" (Johnson, 1984, p. 467).

Elbaz's (1983) study paints a picture of the teacher as a professional, operating in a dynamic, two-dimensional world of practice, one that is not only personally-defined but also, contextually grounded. This work stresses how productive it might be to investigate teachers' entire worlds of practice instead of phases of teaching. Also, Elbaz provides a means of weaving teachers' implicit theories, beliefs, self-knowledge and principles of teaching, into the complex ecology of classroom life, to make the rich tapestry that is teaching practice.

### 2.2.2. Professional Knowledge

Very recent studies of teaching have prompted further understanding of the complexity, yet oneness, of teachers' worlds. It has been proposed that teachers have views of practice that are developmental, responsive to and dependent on the teaching context and that these guide their teaching (Lampert, 1985; Clandinin, 1986; Larsson, 1987; Oberg, 1987; Yinger, 1987). The literature also attests to the role of improvisation and reflection in teacher decision making and to the prevalence of "person-directed superscripts" which influence teaching practice (Dillard, 1986; Smith & Neale, 1987; Lampert, 1987). This area of study is new and warrants further inquiry.

The following conclusions may be drawn from the studies cited above:

(1) The teacher's world of practice is complex and intricate, but coherent in itself and each individual teacher is instrumental in cognitively creating a world of practice.

(2) Teachers have certain understandings of themselves, the teaching context, pupils and subject matter, all of which contribute to the making of their worlds of practice.

(3) In a teacher's world there are two broad domains; professional, personal perceptions and practical, contextual concerns, both of which are interwoven, not discrete in a teacher's world of practice.

The discussion that follows will deal with the nature of worldmaking itself and the implications of this knowledge for the nature of teachers' worlds of practice.

## 2.3. Nature of Worldmaking

For teaching practitioners teaching practice can be thought of as a process of construction or worldmaking (Erickson, 1987; Grimmett et al, 1987; Oberg, 1987). The term "worldmaking" has been made popular by Nelson Goodman (1972). But, the idea that persons actively engage in their own construction of reality has been the topic of discussion by many a theorist (Wittgenstein, 1953; Kelly, 1955; Arendt, 1971; Vickers, 1984). To describe how teachers make their worlds of practice, it is necessary to have a general knowledge of the nature of worldmaking itself. This section will outline Kelly's (1955) and Goodman's (1972, 1984) positions on how persons construct their personal realities and "make" their worlds. These references will provide a useful backdrop against which to speculate on how teachers engage in their practical worldmaking.

Kelly's (1955) Personal Construct psychological theory states that persons construct their realities and that individuals make sense of their worlds, through networks of abstract convictions called personal constructs, which are derived from personal experience. A construct is defined by Kelly (1955) as a bipolar abstraction through which a person, like a scientist, sees, builds and rebuilds personal reality. Constructs are therefore revised in the light of new personal experiences. For Kelly, this

exploration, construction and reconstruction of reality is an ongoing individual process but, groups of individuals who have common experiences may also happen to share some constructs.

Kelly's Personal Construct Theory is particularly relevant to the aims of this investigation of teaching practice. Each teacher operating in a classroom brings into play personal constructs and experiences and these can account for the variability of teaching practice. But, despite the individual, autonomous nature of teaching practice, teachers are likely to have some professional perspectives in common. Whether and how these are influenced by teachers' sharing in certain elements of practice, from teacher training or from teacher socialization is an issue of some debate (Lortie, 1975; Zeichner & Tabachnick, 1983; Feiman-Nemser & Floden, 1986). Lortie (1975) would say that, "such convergence can arise from the diffusion of a subculture. On the other hand, it may derive from common responses to common contingencies" (p. 162). Looking at the worldmaking processes of individual and or collaborating teachers is one way of finding out the extent to which a particular group of teachers do share certain constructs. Therefore the general problem of this study is an application of, not only Kelly's (1955) principles of personal construct theory, but also Goodman's (1984) ideas on worldmaking.

In one of his early works, Problems and Projects, Goodman (1972) contends that, to think about the way the world is, it is

necessary to include thoughts of the following:

(a) the way the world is given,

(b) the way the world is to be seen, and

(c) the way the world is to be described.

Goodman's line of reasoning above is worth mentioning in this dissertation, which is neither philosophical in origin nor in intent, because the substance of it can be a useful referent for this inquiry. Major points in Goodman's conception of worldmaking are outlined below. What he has to say about "the way the world is to be seen" is of particular interest in this study since it is an exploration of the way in which teachers perceive and make their worlds of practice.

There is, Goodman (1972, 1984) claims, no single "way the world is" but many ways and many worlds. He affirms that there is merit in probing "the world as it is given" to us through experience. There are nevertheless practical constraints or influences on experience. According to Goodman (1972):

> The issue is not <u>what</u> is given but <u>how</u> it is given. Is it <u>given as</u> a single whole or is it <u>given as</u> many small particles? (p. 26).

Goodman's consideration of "the way the world is seen" is directly relevant to an inquiry into teaching practice which has

both personal and contextual influences. There are, he affirms, many ways of seeing, whether they are taken to be real or to be distorted. Even "distorted" images draw attention to an aspect of reality previously unrecognized or ignored,

> For the ways of seeing and picturing are many and various; some are strong, effective, useful, intriguing, or sensitive; others are weak, foolish, dull, banal, or blurred. But if all the latter are excluded, still none of the rest could lay any good claim to be <u>the</u> way of seeing or picturing the world the way it is (p. 29).

Similarly, this study aims to capture and report one of the many possible ways of viewing practice, in the hope that such knowledge can only enhance understanding of the complexities of teaching practice.

As to "the way the world is to be described", the central question, Goodman (1984) says, is whether any description of the world can "faithfully depict" that world. But, in any event, he quips, even the "truest" description could not faithfully reproduce the way the world is for,

> ... if we say that all true descriptions and good pictures are equally unfaithful, then in terms of what sample or standard of relative faithfulness are we speaking? We have no longer before us any clear notion of what faithfulness would be. Thus I reject the idea that there is some test of realism or faithfulness in addition to the tests of pictorial goodness and descriptive truth. There are very many differing, equally true, descriptions of the world and their truth is the only standard of their faithfulness... None of them tells <u>the</u> way the world is, but each of them tells

> us a way the world is....Since I am concerned with the ways the world is, my response must be to construct one or many descriptions (p. 31).

According to Goodman (1972, 1984), individuals make their own worlds and there are many versions and many worlds made. This suggests that there is worth in describing truthfully any version of any of these worlds for no single description of any world can be judged on its precision. Nor would it be possible to say precisely how adequate any description of another's world might be. Any faithful version or description of a way the world is, should therefore be as acceptable as it is revealing. Goodman (1984) is himself "convinced that there is no one way of describing or picturing or perceiving the world, but rather that there are many equally right but conflicting ways--and thus, in effect, many actual worlds..."

Both Kelly's Personal Construct Theory and Goodman's stance on worldmaking, suggest that one basic claim can be made here, namely that a constructivist epistemology is an appropriate and productive way of conceptualizing teaching practice (Schon, 1983; Erickson, 1987). It seems reasonable that persons build their own views of reality; create their personal worlds. This investigation of teaching practice is founded on this fundamental tenet.

This study is an attempt to explore and portray teachers' worlds. Teachers' professional and personal views are known to be

a basis of the practice and culture of teaching (Jackson 1968; Lortie, 1975, Feiman-Nemser & Floden, 1986). Goodman's stance is a useful one on which to base this study of teaching, not only because it implies that the world of teaching is neither fixed nor unchanging, but also because it attests to the value of capturing, portraying and understanding any version of the many possible worlds of teaching practice. From the viewpoint of practitioners, worlds of practice are indeed dynamic and changeable (Benner, 1984; Schon 1983, 1987). It is not reasonable, therefore, to claim to depict, with any degree of certainty, the way the world is for teachers, but certainly, it is possible to picture a way the world is for teachers. This enquiry is an attempt to portray one version of teachers' worldmaking--one snapshot of one of the many ways in which each of the four teachers in this study engaged in making their worlds.

## 2.4. Teachers' Worlds in the Making

To take and display snapshots of another's world, a good lens is necessary for viewing that world. But, using a lens for viewing and representing worlds involves knowing something of the processes of worldmaking. Worldmaking is a mental process of construction (Kelly, 1955; Goodman, 1972, 1984). It must have cognitive dimensions. The writings of Sir Geoffrey Vickers can shed some light on the mental processes and systems associated with worldmaking. According to Geoffrey Vickers:

> The mental models which we build, representing the situations in which we conceive ourselves as acting, contain (at best) as much verified facts and rational deduction as are relevant and available; but they necessarily contain so many assumptions that, if action based on them should fail to have the result expected, we can seldom say which assumption has failed us. And if the facts behind the assumptions are themselves changing historically, we cannot be sure that a model which works today will work tomorrow--unless we can understand or control the process of change itself (1984, p. 48).

In the words of Vickers, this study will attempt to witness how teachers "build their mental models" of teaching practice. As professionals, teachers find themselves in many different kinds of situations in class which, routinely, they manage to decipher and work through. As practitioners, it is in the course of their teaching that they construct the principles on which their practice is founded (Elliott, 1976; Elbaz, 1981; Clandinin, 1986). Any concern about the nature of teachers' practice ought to include consideration of how teachers construe their practical situations, as a prerequisite to making a worthwhile representation of what teaching is, from a practitioner's perspective.

In the course of teaching, according to Vickers, teachers would be engaged in mentally building and rebuilding models of their practice. Practice changes constantly and the assumptions behind "mental models" change with events, situations and concerns that teachers experience daily in their classrooms. Yet, Vickers

(1983) would affirm that teachers, like other professionals, have appreciative systems and so teachers, through their own appreciative systems of practice, are likely to bring to a practice in flux, some measure of consistency and coherence.

Vickers (1983) has elaborated on the way in which humans come by their "mental models" through appreciative systems. He deliberately uses the word "system" to describe facets of the human psyche because he says that they are interrelated in one way or another, as well as coherent in themselves:

> Systems are tools of understanding, devised by human minds for understanding situations, including situations in which human beings appear as constituents. They are not arbitrary constructs. They must include the minimum number of relationships needed to constitute the situation which is to be understood. But this is defined by its relevance to the concerns of some human minds... Systems are nets of relations which are sustained over time...(p. 17)

An appreciative system, he discloses, is a pattern of concerns and the situations which relate to these concerns. Appreciation itself includes "the power of representing to ourselves situations relevant to our concerns and comparing these situations with standards defining what we should expect them to be and, if different, what we should like them to be" (p. 57).

Problems originate in "concerns" and the likely response to these concerns is to make a mental "representation of the

situation which is relevant to that concern." Professionals are therefore constantly engaged in a process of re-evaluating and refining or changing concerns:

> I regard an appreciative system as a work of art, both personal and social, one that is constantly revised or confirmed by the three needs. First, it should correspond with reality sufficiently to guide action. Second, it should be sufficiently shared by our fellows to mediate communication. Third, it should be sufficiently acceptable to ourselves to make life bearable. It is thus a mental construct, partly subjective, largely intersubjective, that is based on a shared subjective judgement, and constantly challenged or confirmed by experience (Vickers, 1983, p. 55).

Vickers' (1983) concept of an appreciative system is fundamental to this study for an appreciative system is a useful lens through which to discern, examine and make sense of teachers' worldmaking in practice. Vickers' theory of appreciative systems would imply that teacher appreciative systems operate in the following manner. A teacher experiences a practical situation and has certain appreciations of it. In accord with any of these appreciations, responses are devised, evaluated and re-evaluated by the teacher "with the aid of criteria set by other concerns." A web of concerns begin to be "set" as a problem. Finally, "a problem begins to emerge. Solutions are sought. Action may or may not follow" (p. 55).

In other words, an individual experiences a concern, frames that concern within a web of other concerns and based on a set of

personal criteria originating in those concerns, proceeds to see and formulate an appropriate problem for resolution. Deciphering concerns does not always mean that action is required and appreciation itself does not necessarily involve action. Appreciation is not solely either thinking or doing. A teacher appreciative system incorporates elements of understanding, rethinking and reacting to a situation in practice. Teacher appreciation can contribute to the definition of a practical problem as well as to the decision to dismiss or solve that problem.

There are three reasons for the use made of appreciative systems in this investigation of teachers' practical worlds. Firstly, appreciative systems are applicable to the work of teachers. Teachers are practitioners (Schon, 1983, 1987; Erickson, 1987). Elements of teaching expertise are built during the practice of teaching (Elbaz, 1983; Connelly & Clandinin, 1984). Despite claims about teachers' lack of professional knowledge and the absence of a teaching culture ( Jackson, 1968; Lortie, 1975; Sarason, 1982), it has been established recently that teachers have and use various forms of personal and practical knowledge which do not arise in isolation of the teaching context (Lampert, 1981; Elbaz, 1983; Lightfoot, 1983; Buchmann, 1984). Possibly, the practical dilemmas that some teachers are said to face, are not simply an outcome of the isolation of their work (Lortie, 1975). Examining teachers' appreciative systems of practice could lead to

identification of what is personal and what is shared within the practice of teaching. The limits of any professional common ground that teachers may share can be mapped by exploring and comparing the appreciations of teaching practitioners within a context. Similarly, the existence of this common ground may point to the potential of identifying a "culture" of teaching.

Secondly, the concept of an appreciative system signifies that it is necessary to depict the concerns that teachers recognize in their practical situations. From these concerns may stem clues as to how teachers understand and frame problems and use their convictions to work through practical problems. Again and again, teachers are said to have implicit theories and conceptual or belief systems about their work (Bussis, Chittenden & Amarel, 1976; Olson, 1981; Munby, 1983). They have also been recognized as thoughtful, reflective professionals (Schon, 1987; Munby, 1987; Erickson, 1987). But for the most part, teacher thinking has been examined in discrete phases, preactively (Yinger, 1980; McCutcheon, 1981) or interactively (Marland, 1977; Conners, 1978) and it is still not clear what role teachers' preconceived convictions play in their teaching acts (Clark & Peterson, 1986). Teacher appreciative systems may provide an opportunity of investigating the thoughtful processes of teaching practice as an organized whole.

Thirdly, elements of an appreciative system, as Vickers

(1984) outlines them, form an appropriate alternative framework within which to conceptualize and analyze teaching. There are, he says, three essential elements of appreciation, rationality, contextual understanding and empathy. Rationality is much like logical deduction or reason. It is a given of a human system, the sort of thinking that matches teachers' preactive planning moves (Morine, 1976). Contextual understanding parallels the creativity and intuition which practitioners are said to apply to deciphering and responding to uncertain practical events (Clandinin, 1985; Buchmann, 1985; Larsson, 1987; Dillard, 1987). Empathy refers to the extent to which personal appreciations of a situation can be shared with others who have "experienced the thoughts and emotions which we attribute to them." Again, this aspect of teaching practice has not yet been fully explored but as an element of teachers' worldmaking, it does have the potential to highlight possible aspects of a "culture" of teaching (Feiman-Nemser & Floden, 1986).

## 2.5. Chapter Summary

The previous discussion has served to emphasize the following points:

(1) Worldmaking is a process of personal construction and creativity.

(2) As a professional activity, worldmaking can contain

elements that may be held in common by teachers.

(3) Worldmaking is a mental process and therefore cannot be seen directly. For its investigation, a "lens" is necessary.

(4) Appreciative systems are an appropriate lens for examining teachers' making of their worlds of practice.

In the first chapter the problem of this study was said to be one of investigating teachers' worlds of practice, as they see them. In this chapter, the literature was reviewed to indicate that teachers do indeed construct their own practical worlds and that there are two major dimensions of these worlds, the personal and the contextual. Teachers' views of reality are reflected in their worlds of practice. Their realities revolve around their practical knowledge, their implicit theories and their teaching techniques, whether deliberative or improvisational. Teachers' thought processes, feelings, perceptions of themselves, their pupils, the subject matter and the manner in which they respond to the day-to-day contingencies of teaching, all contribute to their worlds of teaching practice. In the following chapter, the procedures for looking into teachers' worlds in the making are presented.

# CHAPTER 3

# RESEARCH AND ANALYTIC PROCEDURES

## 3.0. Introduction

This study investigated the nature of the practice of teachers of elementary science at the primary and intermediate grades. The contents of this chapter focus on the procedures used by the researcher to witness, search out and represent how these teachers perceived their teaching practice.

## 3.1. Setting of the Study

Data for the study were collected during a period of economic and political "restraint" when the climate for teachers and schools in the province of British Columbia was quite turbulent. There was no intent, however, in this study to focus on the annoyances of the time, except to express gratitude to teachers for volunteering to give their cooperation and support to this project so willingly, despite their difficult circumstances.

Four different cases of science teaching were investigated. Each case was the study of one teacher and that teacher's class during the teaching of one unit of science. Two teachers from each

of two elementary schools in the Lower Mainland participated. Both schools were located close to a university campus and drew their pupils from the neighbouring community.

## 3.2. Evolution of the Study

The researcher had previously worked with teaching staff at each of the two schools in the study, as a supervisor of student teachers prior to the start of the study. For the purposes of this project, contact was first made with one teacher at each school, Dick and Jack. These two teachers had been sponsor teachers for student teachers under the researcher's supervision. One teacher, Dick, regularly taught all subjects to a split grade three/four. The other, Jack, was an intermediate grade science specialist at the other elementary school.

Originally, it was thought that Kelly's Personal Construct Theory (1955) could form the major analytical framework for collecting and analyzing teachers' views. During the pilot study, it became evident that this methodology was not quite appropriate for the intents of this investigation and so it was rejected. The Triadic Grid Elicitation, based on Kelly's Personal Construct Theory, was tried but it did not facilitate the natural flow of teachers' conversations and a conversational technique seemed preferable for collecting teachers' views. Attempts to generate a more suitable procedure for this investigation led to an

acceptance of the construct of appreciation. It is important to stress that in the initial stages of this study, starting with the pilot phase, general theoretical assumptions were seen to guide rather than dictate a particular methodology. The researcher, therefore, came to see that these teachers had certain "appreciations" of their teaching practice and this conception of teachers as having appreciations, became a central feature of the data gathering and analytic procedures. More information on this topic of selecting an appropriate methodology is provided in Appendix A.

Discussions about the study were held separately with Dick and Jack to explain the aims of the study and to seek their cooperation. It was felt that teachers should be well informed about the research intents so that they could have firm grounds on which to base their decisions to participate. After ample time for consideration, both Dick and Jack willingly agreed to volunteer for the project and the extent of teacher involvement was then discussed with their principals.

Pilot interviews were conducted with each of them. During these it became evident that in each case, the teacher worked closely with a colleague at his school in the teaching of science. For Dick and for Jack, the practical reality was that each of them had previously made a professional decision to work in conjunction with a colleague at the school in teaching science. Yet, each

teacher retained exclusive control of his/her class. This was not team teaching, but most decisions on science instruction seemed to be jointly rather than independently made by the teachers in the sample.

Although this situation had not been anticipated when the study was conceived and designed, it was felt that no exploration of either Dick's or Jack's teaching practice could be complete in this event, without including studies of each of the teachers with whom they worked. The inquiry which had been originally intended to be two cases of science teaching became four cases of science teaching. Furthermore, in exploring the appreciations of each teacher for elementary science, the nature of their collaborative efforts with another teacher also came under scrutiny. Each teacher approached his partner about participation and both of the partners agreed to participate. The interviewer subsequently met with each partner separately, to discuss the purposes and methods of the study and their involvement.

This exploratory inquiry was planned as two in-depth case studies of science teaching. During the course of the inquiry itself, it evolved into four case studies of science teaching with the added dimension of examining how, in each case, individual teacher appreciation contributed to the fabric of voluntary teacher collaboration which existed in the teaching of elementary science.

## 3.3. Data Collection

### 3.3.1. Phases of Data Collection

As conceived and pursued, the present study falls within the naturalistic paradigm (Lincoln & Guba, 1985). The research process set about to trace events as they unfolded in their natural setting. A report on this shifting, evolving research path can only portray to a limited extent, the actual events. The phases of data collection are presented below. But, it is important to mention that these phases would not have been readily recognizable during the actual process of data collection.

Data gathered in this study consisted of teacher conversations, teacher observations and observer field notes. Documents, such as teacher notes and tests, used by the teachers in their teaching of units observed for this study, were also collected. There were three major phases of data collection:

Phase 1 - Pilot conversations and teacher observations during one week of science classes.

Phase 2 - Formal reflective teacher conversations with each teacher and observations of all classes during teaching of the unit (two weeks equalling six

classes in each case).

Phase 3 - Formal interpretive teacher conversations with each pair of teachers.

3.3.2. The Teachers

The sample consisted of four elementary teachers drawn from two schools in the Lower Mainland. Each teacher had a minimum of five years and not more than ten years teaching experience. They were willing to give of their time to the project for interviews, were agreeable to being observed in their rooms teaching and were in agreement with the general purposes of the study. The researcher previously had a professional working relationship with two of the teachers and they were invited to participate because of this and because they had a reputation of being "good" teachers. Two teachers, Dick and Donna were generalists, teaching all subjects to their classes. The two other teachers, Jack and Jessica were specialists. Jack and Jessica were at a school where a "platooning" system enabled a teacher to develop and teach a specialty. These teachers, Jack and Jessica, shared the teaching of science to all the intermediate grades. Background information on each teacher is available in Appendix B.

### 3.3.3. Conversations with the Teachers

Formal and informal conversations were held with each teacher over the two-year period in which data were collected. A schedule of interviews was designed to match the availability of the teachers in the sample. (Refer to Appendix C). Notes of informal teacher conversations were kept as part of the researcher's field notes. To maintain the conversational mode, formal conversations were audio-taped and transcribed for analysis.

There were two types of formal conversations, reflective and interpretive. These conversations were held with individual teachers as well as with each pair of teachers who collaborated. In reflective conversations, teacher observation narratives were used to anchor and focus the discussion. The main purpose of the reflective conversations was to enable the teacher to express personal views as well as to extend and clarify them. Conversations were held at various points throughout the unit depending on when the teachers were available. The final conversations were interpretive. These were held with each pair of teachers in a face-to-face discussion with the researcher, as a final communication with the teachers and also for the teachers to voice their own impressions of the researcher's preliminary interpretations of their appreciations. These conversations were also audiotaped.

Dialogues with teachers were considered to be conversations rather than interviews because they followed the natural pattern of conversational flow and had less of the artificiality of structured interviews. However, teacher conversations in this study were purposeful in that they ultimately pursued answers to the research questions, while allowing for the flexibility and spontaneity of natural conversation. The fact that teachers were very fluent and lengthy in their discourses with the researcher seemed to support this choice of technique.

For each conversation the researcher had a list of open-ended questions. Sample protocols are presented in Appendices D and E. Each conversation took its own shape and had its own flow. Conversations of this nature are an acceptable technique of holistic ethnography (Jacob, 1987). In naturalistic studies of this kind conversational techniques have been viewed as an effective medium for tapping into another's world and in particular into teachers' worlds:

> Such conversations can bring to full awareness neglected perspectives on teaching, its complexity and richness as a practical art. They can give teachers a chance to think, to reflect not so much on what will be done tomorrow but on what has been done and is too easily forgotten. (Yonemura, 1982, p. 241)

Including those of the pilot, at least four sets of formal conversations were held with each pair of teachers during this investigation. All of these served as data for the study.

### 3.3.4. Observations of the Teachers

Observations of two units of science teaching were made in each case. The first set of observations belonged to the pilot phase. The second set were observations of lessons in the unit taught during the period when the reflective teacher conversations were held. The observer did not participate in class activity during observation of teachers. The activity and words of the teacher became the focus for observation narratives, following guidelines suggested by Doyle et al (1982) in Appendix F.

Observations were intended to provide a rich ground for discussions with teachers and a means of providing the researcher with contextual clarification of the substance of teacher conversations. The narratives were prepared with three questions in mind:

(1) What personal principles seemed consistently to drive a teacher's practice? For example, how did the teacher relate with pupils?

(2) To what extent did a teacher implement these principles in the light of a collaborative plan with a partner?

(3) What were each teacher's comments on the teaching of

that unit in light of the collaboration?

A sample observation narrative is available in Appendix G.

### 3.3.5. Other records

Field notes were kept daily. These consisted mainly of the researcher's personal queries, descriptions and impressions of the events under study. Initially, these insights were particularly important in the formulation of appropriate questions to generate and maintain the flow of the conversation. Later on, these notes were useful checkpoints in analysis. Other documents were also gathered. These dealt mainly with the subject matter content of the lessons being taught. Both pairs of teachers covered units on the Systems of the Human Body during this study. Specimens of teachers' scripted plans, students' work and other information used by the teacher in the unit were collected and samples of these are included in Appendix H.

## 3.4. Data Analysis

### 3.4.1. Phases of Data Analysis

Underlying analysis of the data was a desire to move away from the data progressively, in order to counteract "overidentification of the inquirer with the cultural values that characterize a group"

(Lincoln & Guba, 1985; p. 177). Consequently, various levels of analysis have been employed and these have occurred throughout the phases of the study shown in Appendix C.

In order to respond to the major research questions of the study, which focussed on finding out what appreciations of practice teachers had, analysis of the interview data was conducted in the following phases:

(1) operationalizing "appreciation",

(2) identifying appreciations of science teaching for each elementary teacher in the sample,

(3) typifying these teacher appreciations,

(4) indicating the types of teacher appreciations which comprise a teacher's appreciative system,

(5) comparing teacher appreciative systems so as to describe their common and distinct features, and

(6) discussing the significance of these common and distinct features in terms of the ways in which these teachers handled the complexities of their worlds of practice.

### 3.4.2. Operationalizing "Appreciation"

The intent of this investigation was to portray what it was like to be an elementary teacher of science, and in so doing, to understand the way in which practising teachers appreciated certain aspects of their science teaching practice. Appreciation has been used as a conceptual tool for describing teachers' practice. This results from the assumption that, for teaching practitioners, there is an element of thinking in their doing which makes it inappropriate to consider teaching practice exclusively as a preactive-interactive operation. Rather, practice incorporates elements of (personal) thought and (contextualized) action whose connection is not necessarily consequential, but integrated (Schon, 1987; Yinger, 1987).

The conceptions of appreciation and appreciative systems used in this study are derived primarily from the works of Schon (1983, 1987) and Vickers (1983). Schon has defined an appreciative system as the "set of values, preferences and norms in terms of which professionals make sense of practice situations, formulate goals and directions for action, and determine what constitutes acceptable professional conduct" (p. 33). For Vickers (1983), what he means by appreciation is this:

> Under appreciation I have included the power of representing to ourselves situations relevant to our concerns and comparing these situations with standards defining what we should expect them to be and, if this

> be different, what we should like them to be. Even where these exercises do not invite covert action, they involve understanding, which is also an activity (p. 57).

Appreciation, as defined by Vickers and Schon, is a construct that is central to this enquiry for it involves how persons make meaning of and represent to themselves their personal understandings of the world. Their meanings of appreciation imply that when teachers appreciate practice, they form their own understandings of the situations they see and operate in. In fact, according to Vickers, when teachers see and represent to themselves instances of practice, they would be engaged in "activity", though not necessarily observable "activity", and so he calls this "covert action". Vickers' "covert action" is equivalent to Schon's "reflection-in-action". Using the construct appreciation, and systems of appreciation in this study is an attempt to deemphasize a linear, consequential relationship between thinking and doing in practice and to explore the importance of reflection-in-action or covert action in teaching. However, in the course of the study, the construct of appreciation itself evolved and this is discussed in Appendix A.

### 3.4.3. Identifying Teacher Appreciations

After teacher conversations had been transcribed, the transcripts were examined and broken into segments. Each segment of the transcript which referred to a situation in practice was used to

identify how that teacher appreciated some aspect of science teaching practice. Such a segment was then paraphrased into a shorter summary statement to convey the meaning of comments in that portion of the transcript. Each summary statement was taken to be an appreciation. Thus, a teacher's appreciations are considered to be that teacher's contextual understandings of practice.

For example, while reflecting on how she dealt with a particular pupil, Donna remarked that:

> ...there are no limits being set or have been set in his life--the limits he is learning, he is learning here, so, you'll see me deal with him in a very direct manner... He is super bright. He finds it difficult to carry through tasks but he has a lot of curiosity and ability. Again, that has never been channelled that much. Now in this group, he may have his success... It is just a question of having lots of ideas, lots of dreams, lots of plans and some come to fruition. He is able, has lots of enthusiasm, lots of curiosity and a great general knowledge. He is a good reader. He loves science... I would say that I'm after him to submerge some of those characteristics and bring them into the group...

The following appreciations were drawn from this excerpt:

(1) Dealing with difficult pupils in a direct manner.

(2) Setting limits for classroom conduct.

(3) Channelling individual pupil curiosity and ability

into success for the class as a group.

(4) Helping an able but difficult pupil bring more of his ideas to fruition.

### 3.4.4. Typifying Teacher Appreciations

The list of teacher appreciations for the sample was carefully examined and it was found that teacher appreciations referred either to teachers' views of their professional identity as practitioners or to their preferences for practice. Thus, a teacher's appreciative system was taken to include teacher appreciations of two kinds:

(a) Professional Identity, and

(b) Preferences for Practice.

This investigation was concerned with exploring how teachers saw and interpreted their worlds of practice. It was therefore necessary to characterize the teacher appreciations that related to a teacher's practice. Typifying teacher appreciations was necessary in order to obtain answers for the research questions and also to serve the following purposes:

(1) to make teachers and their appreciations more amenable to description and comparison in this report,

(2) to show how teachers' appreciations might impinge upon situations of practice, and

(3) to facilitate a discussion of the interrelationships among teacher appreciations that contribute to identification of broader issues in these cases of elementary science teaching that, from a practitioner's viewpoint, have the potential to act as options for, or as constraints on, teaching practice.

Such a typification cannot be said to apply to all teachers' appreciations of practice or even to all of the appreciations of the teachers who participated in this study. But, these appreciations have emerged from the teachers' own comments and reflections on their practice. As such, these appreciations do constitute one version of the teacher's world of science teaching, and to this extent, they can provide a useful snapshot of teaching practice, which may contribute to better understanding of the teaching of elementary science.

### 3.4.4.1. Professional Identity

Teacher appreciations of identity did not necessarily pertain to any one specific aspect of teaching practice. They concerned the teacher's view of self and perception of the role of a teaching practitioner. Appreciations of identity represented a form of "appreciating-me-as" for the individual teacher. Some examples of the ways in which teachers characterized themselves in teaching roles, follow:

(a) Liking science is the key to good teaching.

(b) Being satisfied with the job I do.

(c) Not being afraid to face new challenges.

(d) Believing that knowledge automatically has a spin-off in terms of understanding and therefore in being able to cope with the world.

Generally, these appreciations were personal convictions about the practice of teaching in a particular context.

3.4.4.2. Preferences for Practice

Other appreciations appeared to be a means of construing the context in which the practitioner was operating; a way of "appreciating-the-situation-with-me-in-it-as". These appreciations seemed to reflect the teacher's way of judging and shaping situations of practice.

Appreciations of preference seemed to relate to a teacher's view of the options or reactions seen as being available to that teacher. Here are some examples of appreciations that have been categorized as "preferences for practice":

(a) For kids, being in a science room for science changes their reaction to the subject.

(b) Finding the right balance when handling a topic in science is important.

(c) Devising activities that facilitate learning science outdoors.

(d) Always looking for resources that are "hands-on", interesting, good for the age level of the students and fit into science.

(e) Ensuring that kids are not paired in class on more than one occasion with the same "pain-in-the-neck".

(f) Selecting strong leaders to ensure group guidance and more potential for success of the group and of the class.

In the process of analysis, some of these appreciations appeared to have a bearing on the ways in which these teachers ran their classes. On the whole, these appreciations were more likely to be consonant with the teacher's personal construal of the limits of a practical situation. Frequently, they seemed to point out criteria that were used by the teacher for shaping instruction. Generally, appreciations of professional identity or of preferences for practice expressed teachers' contextual understandings of their practice.

### 3.4.5. Teacher Appreciative Systems

Transcripts of teachers' interview data were analyzed in order to select teachers' appreciations of their science teaching. Two types of teacher appreciations were inducted. These were either of identity or of preference. These two types of teacher appreciations and their relatedness to particular aspects of teaching practice, constituted a teacher appreciative system. A profile of the teacher appreciative system of each teacher is presented in the next chapter. Appreciative systems of teachers

are compared in the chapter after that.

The teacher appreciations which comprised the appreciative system of each teacher are listed in Tables 4.1 to 4.4. Key elements of these systems are discussed in the narratives that follow. This is done to indicate how teacher appreciative systems were seen by the researcher to have some bearing on each teacher's view of the context of practice. It is considered important, in the course of discussing how teachers appreciated their practice, to use their own words to substantiate how teachers really expressed these appreciations. Excerpts of the actual conversations with teachers are therefore included in the reflective narratives in this chapter. Readers are encouraged to use these excerpts to compare their own views of these teachers' appreciations with those expressed here by the author. A specimen of an interview transcript is also appended for reference.

## 3.5. Chapter Summary

This was a naturalistic exploration of teachers' worlds. It has to be emphasized that in a study of this nature, the gap between the processes of research and the reporting of these processes is recognizable. The research process is dynamic, three-dimensional and changeable, varying its path and patterns of investigation with the ideas and events that mould its evolution. The research report, on the other hand, has to be uni-dimensional and static,

limited in the extent to which it can realistically portray the sharpness of those images which it attempts to describe. Lincoln and Guba (1985) claim that "it is the function of the case study... to provide the essential judgemental information about the studied context" (p. 217). Taking the above mentioned considerations into account, attempts have been made in this dissertation to present enough "judgemental information" for the reader. Following the suggestion of Lincoln and Guba (1985), this has been done through description.

Chapter 4 follows. It contains descriptions of the teacher appreciative system of each of the four teachers in the sample. Each teacher appreciative system is coloured by key appreciations which seem to characterize that system itself. Case descriptions of the four teacher appreciative systems are presented as narratives in Chapter 4. The contents of Chapter 5 focus, not on the nature of teacher appreciation as in Chapter 4, but on the comparability of teachers' appreciative systems, making the theme of teacher collaboration a dominant part of the discussion in Chapter 5.

# CHAPTER 4

# TEACHERS' APPRECIATIONS OF SCIENCE TEACHING

## 4.0. Introduction

This chapter contains descriptions of each of the four cases of teaching studied. Case descriptions are presented as four narratives, one for each of the four teachers who participated in this study and each narrative portrays the key elements of a teacher's appreciative system shown in Tables 4.1. to 4.4.

In essence, an appreciative system is a coherent collection of a teacher's ideas about practice, that might signify the kinds of knowing-in-action and reflection-in-action that epitomize science teaching practice for that teacher. However these aspects of teaching are a part of the realm of an individual's perceived reality. Therefore, in the course of attempting to describe perceived realities of these teachers through appreciative systems, it has to be acknowledged that "reality for an individual--or group or even a discipline--is at best only a partial picture of the whole, and will continue to remain so. But, ... that there is a reality out there" (Lincoln & Guba, 1985, p. 83). Hence, the portrayals presented here are not intended to be the complete picture, but only one of the many possible

Table 4.1

TEACHER APPRECIATIVE SYSTEM - DICK

PROFESSIONAL IDENTITY

A LOVING, DEMANDING, INDIVIDUAL STYLE

having a definite philosophy and style

having an agenda that "he is less flexible about"

feeling that he is a good teacher but also recognizing shortcomings

SEEING PRACTICE AS "INPUT-OUTPUT"

working with a certain "structure"

putting in "love, scientific knowledge and skills"

"getting out what you put in"

having cognitive goals

continuing to work in the belief that students gain a certain amount of knowledge

wanting to take responsibility for student learning

doing his best to "draw information out of pupils"

KNOWING WHAT TO EXPECT FROM PUPILS

not expecting to get anything without demanding "stuff" from pupils

having individually tailored pupil expectations

not expecting the "unable" to do something beyond their means

gathering personal background information on pupils

expecting pupils to "do" the work

expecting pupils to read the text, draw out facts and then do tasks

hoping his expectations are high and that all pupils will get an "A"

Table 4.1 (contd.)

PREFERENCES FOR PRACTICE

"STEPPING IN" AND DIRECTING

preferring a "teacher-directed" mode in class

concerned about not "teaching science" but "teaching organizational skills through science"

spreading out "trouble makers"

knowing pupils and taking into account individual pupil ability

setting certain limits for whole-class discussions

placing pupils who need help with others who can help them

MORE SOCIAL STUDIES: LESS SCIENCE

science is not the same as reading

finding time for science among other class activities

having "huge" social studies that year and doing less science

WORKING WITH A COLLEAGUE

not being able to work and someone who is "slapdash"

measuring himself against Donna

having the same commitment to precision

speaking about ideas and sharing ideas for a unit

using ideas more broadly

sharing commitments

focusing on content

finding topics and devising formats for covering topics

anticipating how it would all work out

having a strong image of self and focusing on self-improvement and self-criticism

Table 4.1 (contd.)

DESIGNING THE CONTENT

only using the textbook sometimes

always trying to involve field trips

working on writing up and recording experiments

using a checklist as a "formal" lesson plan

doing worksheets

preferring to have experiments

doing a lot of "informal planning" with Donna

COVERING THE FACTS

expecting students to "know the facts"

having pupils absorb the facts

feeling that pupils haven't grasped facts to the extent he had hoped

wanting to see his cognitive objectives met

shapshots--one possible perspective of each teacher's system of appreciating practice.

This discussion of teacher appreciative systems follows a synopsis of the way in which appreciations were elicited from the raw data, presented in the previous chapter. Descriptive narratives of teacher appreciative systems contain as far as possible the teacher's own words. This is done to reflect the extent of the reality captured in conversations with the teachers and also to allow the reader to make independent judgements of the meaning that can be ascribed to such appreciations.

## 4.1. Teacher Appreciative System - DICK

### 4.1.1. Professional Identity

#### 4.1.1.1. A Loving, Demanding, Individualized Style

Dick has a well-formed image of himself as a teaching professional. He points out that he has a definite philosophy and style of teaching. His philosophy is that "education is a process in which students gain knowledge, understanding and skills." This, he claims is an "agenda that I am less flexible about" but it is a fairly "simplistic way of fitting it all into a nice box":

> My definition of education is having knowledge of and understanding about the world and being able to cope

> with it. Therefore pupils have to know the facts of the digestive system in order to have knowledge of it. That's the knowledge. They would have to be able to explain it. That would be the understanding. And they would have to have some experiment or hands-on activity which would show that they were able to cope with it to some extent.

He is definite about his role as he sees it and painstakingly explains how his "philosophy" is different from his "style":

> My style is me--me as an actor, as a person, a being. My philosophy is me as a thinker, as a form of intelligence. I suppose they are indivisible.... I have a style that is loving, demanding and individualized. But I have not decided that the best way to promote knowledge or understanding is through a teaching style that is loving, demanding and individualized.

It would appear that when he uses the term, "philosophy", he does so to refer to his collective appreciations of teaching, in an ideal sense. Style would be his collective appreciations of his teaching in the setting where he works. Possibly, he has always had this philosophy. But over time, and with changing experience, he has operationalized certain aspects of this philosophy into a style which looks like the one he currently uses. Style is the way he implements his philosophy in his current work environment.

4.1.1.2. <u>Seeing Practice as "Input-Output"</u>

At first, it seems that this teacher has a somewhat mechanical view of practice. If he can "put in" love, scientific knowledge

and skills; demand understanding and treat pupils as individuals, he will "get out" of them as information, the knowledge they have assimilated. This will demonstrate that they can cope with the world. He will have done his part.

His appreciation of teaching may be considered "simplistic". Apparently, he views his role as one of instilling the knowledge and understanding of science into his pupils and this appreciation dominates his practice. As the unit progresses, it becomes evident that his adherence to this mechanical way of framing practice, dictates how he sees what he does, how he looks back on what he did, and how he reflects on the level of success he has achieved with pupils.

On the other hand, his views may not be as superficial or simplistic as they are pragmatic. Here is a professional who has an appreciation of his work which is strong and personally motivating. He has a clear vision of the work to be done as well as his own role as a provider of knowledge and skills. The teaching context demands that he serve the whole group of about thirty pupils in his class and that he give each of them an equal opportunity to assimilate the knowledge and skills he communicates. Yet, he remains committed to catering to the individual pupil, though he willingly acknowledges that his students have unique and different capacities to receive and use the information he provides.

To bring all these individuals to a similar level of proficiency must be risky for him. He may or may not be successful. In this respect, he realizes how uncertain his practice is. To survive and continue to regard himself as a professional capable of doing his work well, he has to persist in thinking that what he does is of value. His intervention as a teacher may make a difference to the knowledge of science held by certain individuals in his class—if not to the entire group as a class. He expresses the extent of his professional commitment in this manner:

> I've never really analyzed or evaluated what I do in terms of student learning.... I have no knowledge of whether or not their own science understanding has enlarged over the long term. I don't really know whether their understanding of the world and ability to cope with the world has been increased but I certainly continue to do my work in the belief that it has and I feel certain that all the students have gained a certain amount of knowedge.

By working with a certain "structure", he increases his chances of reaching the whole group and at the same time achieving his own personal agenda for reaching and developing the potential of each individual in his class. Besides, he has cognitive goals in mind. He wants "facts" from them all and he seeks to get from them evidence of their having the facts. Such a view of teaching prompts him to delimit the work and structure it so that he can obtain the personal rewards he needs to feed his practice:

> I went around the room yesterday and asked a few questions. I pulled out my cards [which are used to randomize his questions] and asked everyone two questions and it ranged from one or two students who couldn't answer a question to some who really had a good grasp of what the body has to do with starch in order to be able to absorb it, and therefore how the digestive system works. So the range is there but I feel though that, generally speaking, although I haven't asked them this, they all know the body has certain systems at work and there are certain different jobs that each system does. I would say the majority of them can give a few facts about each of the systems, given perhaps a few clues.... That was important to me.

His cognitive goals are a tangible expression of his "structure" for operating. Through these goals he can realistically deal with the risk and ambiguity of his practice. He sees himself as the one who has to create the structure, to supply the knowledge out of which, hopefully, will come the "spin-off" of pupils' understanding and their being able to cope with the world. But in class, demands are such that he is unable, from moment to moment, to ascertain with rigour whether his pupils are achieving what he wants for them. He has to rely on his intuitive "feeling" that they are, as individuals, making those gains. The press of classroom life is such that he cannot ascertain with any rigour whether each and every one of his pupils achieves what he wants for that pupil. He has to rely on his own "feelings" of competence. He resorts to his own self-judgement and the wealth of information he has collected on each of his pupils, to reinforce his potential to achieve his goals for teaching.

4 1.1.3. Knowing What to Expect from Pupils

As a consequence of this way of appreciating his work and in keeping with his cognitive intents, he knows what to expect from his pupils. First of all:

> You won't get anything out of kids unless you demand something from them or expect stuff from them. At the same time, kids only produce what you want them to produce if you are a "Tartar" and don't have any compassion.

Then, of course expectations have to be realistic and so he tailors them to suit the particular individuals in his class:

> It is no point expecting the unable to do something beyond his/her means. So my expectations for each child are individually tailored so that I give able students a worse time if they haven't produced what I expected them to be able to do, than I would someone who was less able but produced the same as someone who was able. In science, my individualization comes in the form of expectations and explanations to the kids and the handling of the kids. They pretty well are expected to do the same sort of thing but the output within that would vary. I would expect different amounts and different quality from different kids.... Part of me hopes that my expectations are high and I do believe that all kids can come up with "A".... I do expect them to do the work and therefore, hopefully, that helps. Also, I do feel that I know my students really quite intimately...trying to understand them in ways beyond the mere classroom and academic things.

This coherent system of devising what to instill and knowing what should obtain from his teaching seems connected to his view of himself as one who can judge the output of his teaching in

terms of the achievement of his professional goals as a practitioner. Two factors contribute to his ability to make such a judgement. Firstly, he views himself as having considerable expertise in the subject matter of science. Secondly, he has gathered enough information on his pupils so that he knows them well. His "individualized style" means collecting information about pupils, finding out about family backgrounds and personal experiences, not explicitly, but "in terms of quiet talks" with students. Every time he deals with a pupil, he can be aware of that child as a person. In practice, his dealings are therefore a mix of "loving", "demanding" and "drawing out" again what he has deemed worthwhile for them to know.

Throughout Dick's practice, the theme of individualizing instruction for pupils is dominant. His pupils are individuals and he is painstaking and conscientious in dealing with them as persons with different backgrounds, perceptions and abilities. His vast knowledge of their personal interests and backgrounds enables him to place them in those situations that he perceives will facilitate their optimum levels of learning. "I've always tried", he claims, "to put Sam next to someone that can help him. I try to get them to help each other if possible."

He thinks it his responsibility to foster the growth of each pupil as an individual. It is not only difficult to accomplish this, but also somewhat paradoxical in the reality of a classroom

world with a group of 28 such individuals. Furthermore, he thinks it is his job to monitor the progress of each of them:

> I have some students who have really gone and done some more. Jim has gone out and got some books. Donna really got interested in it [the unit]. She has brought her own books from home and she has read quite a lot from them. And, I think people are listening to tapes quite carefully. But I haven't seen anyone experimenting....what I'm saying is, that's an absolute "A" and I would like to get everybody up there and so this is where my frustration comes. The top five or six or seven are up there but my concern is that, for example, Kathy is bright but this is all we've got for the respiratory system. This is basic stuff and she has the capacity to get up to Harry's level.

Finding solutions to this sort of dilemma is no easy task. As a professional, he has to make choices that are "right for him". But, his search for the appropriate compromise can cause him much frustration and stress. Focussing on individual, cognitive growth for each pupil in science is an admirable ideal but to do so and at the same time, try to move the entire class ahead, as a group, is a practical predicament for Dick.

### 4.1.2. Preferences for Practice

#### 4.1.2.1. "Stepping In" and Directing

At various points in the unit on Systems of the Body, Dick expressed anxiety and frustration about how things were going. The content and techniques he used for teaching this unit had been

jointly negotiated and agreed upon by him and Donna. During the unit they kept in constant contact, monitoring each other's successes and failures, learning from each other. Yet Dick was unhappy. On reflection, he reveals the basis for his discontent and what he would prefer to do himself:

> In this case they were supposed to be giving their presentations. I suspect that Donna's kids did run it all but I very much did step in with my kids and I asked questions and prompted and told kids who had not said very much to say more. So, it wasn't really their presentation. To that extent it was still quite teacher directed in some ways. I feel more comfortable with this sort of thing.

He is unhappy because the techniques that he has jointly negotiated for practice with a colleague do not really fit his own personal appreciative system of practice. He sees himself as one who concentrates on personal understanding. This contract assumes that he cater to the class as a whole. He has to assume a new role, one with which he is not comfortable. Not only that, his expectations of pupils would have to change and he is not quite prepared for that. To make the colleagial contract work for him, he would require a structure different from his own. He said previously that his was an "inflexible agenda". Indeed, that would seem to be the case. Though he has some difficulty expressing it, he sees things working this way for him:

> ... I can neither tell how I will make this decision nor can I tell the decision that has to be made. The decision that has to be made is whether I have to do it

> the teacher-directed way, go through it step by step. Read about such and such. Make notes on such and such. Everybody look at the model of so and so and then explain it. Give them a diagram and have them copy the key words. Do an experiment based on that idea.
>
> If I were to do the same thing as that, I would probably start off with a smaller activity, maybe the same groups, but I would have one group demonstrate. I might have one group give a talk on something they agreed on. We might talk about a tree. Someone might bring a seed and plant it. So we'd take a relatively small scale item and we would have a group working around it. In this way they would get the idea that they have to bring material, they have to plan what they are going to say.

It is evident that although he is seeking to retain control of the whole class, he still struggles to serve individual pupil needs. The "group" to which he refers is merely a device to enable him to cover the content and still maintain his own structure and direction. Through the group, he can monitor and reach each individual. He deals with pupils as individuals and they are all equal in his eyes for he is the one with information on them all and this information places him in a relatively secure position from which to control the class. Consequently, he is uncomfortable and reluctant to try out a system other than his own "teacher-directed" one which works well for him.

4.1.2.2. <u>More Social Studies: Less Science</u>

Seeing science as one of the many subjects that he has to teach, limits his options for designing and implementing science teaching practice. One block of time is set aside for both science and

social studies and this time is then divided between the two subjects. Science and social studies are treated as though they are interdependent. If he manages to do three units of science in a year, he may have to cut back on his social studies in order to get the science in. That year, Dick and Donna had been involved in piloting materials for social studies. The time for this was longer than expected. He found himself in May with time for only one more unit of science, having done one previously. The more social studies he teaches; the less science he can do.

He is able to articulate and rationalize his appreciation of science as an elementary teaching subject quite readily:

> I envisage science and social studies in the same way because of the assignments and topics covered. The materials used are pretty much the same. It is not the same as reading, where you have three groups and you give different groups of students different materials to use. Science has been fairly osmotic, coming out of circumstances such as, knowing the kids.... We've done this year a physical unit on Machines and one on the Body. The thing is that our social studies has been huge this year because we prepared things for the district which we then had to trial run.

This aspect of programming science in a block with social studies probably operates to limit when and how much science is done in a school year. The reality of teaching elementary science, as a teacher of all other subjects too, is that science is locked into a balance with social studies. The more social studies one teaches, the less science one is able to teach, and vice versa. No

other subjects seem to influence this equilibrium.

4.1.2.3. Working with a Colleague

Dick chooses to teach science and social studies in collaboration with his colleague, Donna, across the hall who also teaches a split grade three/four class. He himself teaches a split three/four grade. They have worked as a team in this way for the last three years and he values their partnership highly:

> When we work together, we certainly feel as though the ideas I have are being used more broadly. And teachers like to have their ideas used--get things over to other people. I think I come up with more ideas, at least, more ideas actually get into practice [with a partner] because they don't fly by. They get spoken about, added to and I think the pressure is on to meet commitments, whether they are to the other person or to the program.

However, he has selected this working partner quite carefully. He chooses not to work with another teacher of grade three in that school as a partner because,

> he doesn't have quite the same commitment to precision. I don't know whether he would think through things as tightly as Donna and I do. Donna and I think through things tightly in terms of what the actual work would be and whether or not we would include a particular question on a worksheet and whether an activity will or will not be included. I couldn't work with someone who was "slapdash" about some of those things and who was not prepared to think through things to that extent.

Such careful selection of a partner might indicate that there

is more than one reason for the partnership. While the major intent of the relationship is to enrich and extend the ideas for science instruction, it is also valued for acting as a constant yardstick against which to measure his own professional competence:

> I do measure myself against Donna, perhaps more than I should. I have a strong suspicion that when she did the second lesson, which was getting the groups to go step by step through the main points, she might have identified those steps more clearly than I did, so that everyone in her class knew what was expected of them more clearly. Part of me wants to excuse myself by saying that she does have a different mix of kids; that her kids as an overall class are more able to do that than my kids, but she has very difficult kids.

It follows, therefore, that he would choose someone whose calibre of practice he perceives to match or complement his own.

4.1.2.4. Designing the Content

Together they negotiate what tactics, content and activities comprise the unit. The process for designing the unit is fairly routine now. The protocol is simple. It works like this:

> We're probably quite good now at saying that we'd like to do this topic, that within his topic there are either these activities or there are these sub-topics. Having established those, we look at the relationship between the sub-topics and the textbooks to see how these are covered and whether or not there are experiments to do or so. Then, we're into the writing of worksheets. For me, the worksheets serve an organizational role and they also provide my lesson plan—I don't really do formal

> lesson plans. We do a lot of informal planning through Donna saying, "Well, this really works". And I'd run off and do a checklist.

There are three significant steps in their process of designing a unit of science teaching. The first is purely mechanical and it involves identifying the piece of content to be covered. This is pretty straightforward. The selected topic usually coincides with the teachers' interests or the pupils' interests or both. Major events in classroom life, especially field trips can play an important role. For example, before the students go camping each year, they do a unit on Erosion. The second step is slightly more complex. It involves a hunt for ideas and for a means of rationalizing which ideas are included and in what form they are to be delivered. The text plays a role here. It serves to delimit the content. Perhaps too, the textbook is viewed as a substitute for the official curriculum document. In any event, using the text is one option for selecting acceptable topics as content which can then be embellished, discarded or treated in part.

The final stage of this design process would appear to be the teachers' joint anticipation of how the tactics they have chosen, are likely to fit into their context. This step allows for a sharing of their practical expertise and experiences, as well as reflections on the value of these in the light of the task at hand. This is where the sharing of ideas that Dick values

highly, occurs. What at first glance seems to be an essentially mechanical design process is really a fairly complex exchange of professional but practical "know-how". The "formal lesson plan" that they produce in the form of a checklist, reflects little of the intricate process through which it has evolved.

4.1.2.5. Covering the Facts

This teacher, Dick, thinks it essential to cover the "facts" of science. Cognitive goals are important to him. When he judges his own professional performance, he does so in terms of his ability to get across to his pupils the facts. He searches for evidence of his having accomplished this task, as though the mere provision of facts ought to result in the pupils' assimilation and regurgitation of those facts:

> We talked about that first lesson. I felt it was unsatisfactory, but nevertheless, I did, in the hour or however long it took, go over the facts of at least the skeleton. I mean things did get done... By the end we had covered all four topics. Either by me drawing it out or by them providing it, the topics had been presented. We had some experiments done and everybody had done a write-up on each of the systems. Time had run out and I wanted to stop and most of what I wanted to do was done.

Pupils are expected to read the text and draw out the facts. When they fail to measure up to this standard, he is frustrated. At first, he attributes the failure of the first lesson in the

unit to the way in which this lesson was approached. They, the teachers, should have done it with the whole class, step by step, he says. Then he relents because it seems that some of the facts did reach the pupils after all and he was able to "draw them out".

Much of his interaction with the pupils in science is geared to promote cognitive goals. He wants them to "know" science. They always do worksheets, experiments and work on writing up the experiments. They also try to "involve field trips but these are nearly always based on something in the text." He seems to have varying degrees of success getting pupils to "know" and finding out what they "know". This causes him some frustration:

> I do feel I'm a good teacher but I often fall short and part of this is [that] when I do give tests, and I admit these are often. These tests I'm talking about are written quantitative things--not one to one discussions. When I give these tests, I am generally disappointed with the scores that come up. I feel that the children haven't grasped at least the factual information to the extent I would have expected or hoped.

It would appear that Dick is trapped between his desire to individualize his teaching and to realize cognitive goals for teaching science to the whole group as a content-based discipline. He expects a certain level of knowledge in his pupils. He is their director and he ought to know how much they can or cannot do.

Table 4.2

TEACHER APPRECIATIVE SYSTEM - DONNA

PROFESSIONAL IDENTITY

AS MANAGER/CHOREOGRAPHER

being concerned that they are all "doing the work"

being "kindergarten trained"

feeling that "using paper only fails the kids"

definitely choosing for success--aiming to make this exercise successful

getting the job done; choosing group leaders who will ensure that the job is done

interchange between pupils is really important

being concerned with "the organization of something and how it is going to go"

BEING A GENERALIST

responsible for planning and teaching all the subjects

knowing what to do first, second and third

as a generalist... there just isn't time for science and social studies

advantageous to know the pupils very well but "you can't do all of that, that well, every day"

PREFERENCES FOR PRACTICE

CLASSROOM AS A COLLECTIVE

grouping pupils to bring out their best

monitoring each group

using peer pressure within groups for productivity

excluding obstacles to group success

handling the mechanics of grouping

having a science area in the classroom

finding better ways to increase pupil involvement and commitment

maximizing success for the class as a whole

Table 4.2 (contd.)

WORKING WITH A COLLEAGUE

sharing the workload

working well together

having real trust and appreciation for each other

recognizing and supporting each other's strengths and weaknesses

being one step ahead or one step behind each other and improving on each other's work

helping each other, feeding on each other, prompting each other

having different ways of working in class and "playing a role for each other"

having a colleague learn from her mistakes

HAVING INCIDENTAL SCIENCE

integrating science and oral language and including that in the report card

"incidental science" at assembly time each day

encouraging pupils to do science out of school and bring it in

DESIGNING THE CONTENT

using a field trip as a "grabber"

often working in groups in science

changing when the plan is not working

preparing the class for certain activities

generating excitement about learning science

narrowing the focus of what is to be done - "everything cannot be done"

## 4.2. Teacher Appreciative System - DONNA

### 4.2.1. Professional Identity

#### 4.2.1.1. As Manager/Choreographer

Donna sees herself as the manager of her class and choreographer of all classroom events. She is the person in control in the class. It is therefore her job to ensure that each child is provided with an equal opportunity to achieve success. She is after success for the group as a whole. First she sets that as her target. She knows what she wants to achieve and is able to talk about her goals, concretely and determinedly:

> My aim is to make this exercise successful. I mean, getting the job done. I want people who will ensure that the job gets done. There will be something to present. Perhaps they would not be people that I will always choose but that was really deliberate. I want a presentation from them.

She is committed to her professional role as she sees it. Her job is to see that all of her pupils experience success with the science activities they do in class. When a pupil asks her how to go about preparing for a presentation, this is her reply:

> You are going to be the teacher. You are going to make an agenda. When I present the skeleton or the muscular system, I sometimes lie awake at night and I plan how I am going to present it. I have to know what I'm going to do first and what I'm going to do second and what I'm

> going to do third. Be the teacher. You're presenting this to everyone. They know very little about it.

Her reply reflects her own sense of her job. She is the one who has to "package" the content for delivery to students. Hers is not necessarily to hold that knowledge herself but to organize how it should be presented and to choreograph its delivery in such a way that all of her pupils can make the best of what they receive. She is quite humble about what she knows but she takes the credit for being a person who likes to organize things, so that pupils can achieve their best:

> I think I am more concerned with the organization of something--how it is going to go. I want the management and how the pupils will carry through. And follow-up, I am really concerned about that--how to look in books and, will they get it; that they understand how to set up an experiment and really, really reach the conclusions. I want it followed up. I want to finish it and I want it done well.

She displays a quiet presence in class. Her pupils are generally very excited and enthusiastic in science. The atmosphere is one of a well-oiled machine with smooth activity routines. There is a feeling that pupils want to "do" far more science than the meagre allotment which the timetable provides.

4.2.1.2. Being a "Generalist"

She thinks of herself as a "generalist". This label reveals her

vision of her professional limits. She struggles to overcome the constraints of that position so that she can aim for the success which she thinks all of her pupils must have:

> I call myself a generalist because we are responsible for all the planning and teaching of all the subjects. A big plus is that you really know the pupils and so you have clear expectations for them and what they can achieve. The con is that you cannot do all of that and do it well, every day.

From her vantage point as a generalist, time is a major problem. It is impossible to prepare and deliver two "special" programs as science and social studies at the same time. They have to be handled alternately. At one time in the year she teaches social studies; at another, she teaches science. Problems related to being a generalist teacher, she explains indignantly, make her feel limited professionally:

> How do you plan five or six subjects the next day and get out of here before six at night. I really want to cut down on the planning. I am fed up with the amount of time that, as a generalist, I'm spending at school. These larger classes mean that marking is onerous; this year I have seven to nine pupils more than in the past. This just cuts down the amount of time I can find. I'm even leaning to moving away from being a generalist, to having not so many subjects to teach, because I don't feel I can do that good a job.

Clearly what she perceives she can accomplish in any one subject such as science, is circumscribed by her responsibility to teach all of the subjects. Having to teach split grades and provide for

the needs of two different levels of pupils in one classroom contributes to the difficulties of being a generalist teacher. One way of managing this problem is to set aside a block of time in the year for each subject. When she is teaching science, she is not having to deal with social studies as well and vice versa:

> We have both for a number of years taught split grades, so we have integrated -- sacrificed doing two programs. I find it impossible to plan and collect materials and have two programs at the same time. As generalists, I do not know where anyone would find time to do socials and science at the same time in a week, if you are doing other subjects, there just isn't time.

She is not as confident about her science teaching as she is about her teaching of social studies. She is not as comfortable about science. According to her, science is the weakest part of her program. She does not see herself as being "scientific". Yet, she is excited about teaching science and, as though to compensate for her personal difficulties with the subject, she manages to devise ways of teaching science as "incidental science", integrated with other subjects throughout the timetable. Incidental science occurs in addition to the regular units of science that are timetabled throughout the year:

> This school year, we've done two major units, Machines, physics and this one, Bodyworks. We found ourselves in a position where we were piloting some socials and so that took more time than we normally give. We normally cover three areas of science including physics and chemistry. But this year we piloted two huge social studies units. We had no idea it would be so demanding. It was very successful but we had to present it to teachers and so

on and this science unit has been shortchanged.

To compensate for the drawbacks of being a generalist teacher, Donna has developed well-honed organizational skills. She is proud of the way she organizes and manages her pupils and the subjects in the time she has. Developing particular techniques and strategies is her way of getting the many jobs of a generalist done well. As a result, despite the constraints, she is able to enjoy her science teaching:

> My science and socials programs are often more interesting than my math program, more involving. That is probably because I like them better. I think I try more varied methods in science and socials and I feel more prone to take risk, whereas in math, I figure I know what the objective is. There isn't much risk involved and that doesn't seem interesting to me.

4.2.2. Preferences for Practice

4.2.2.1. Classroom as a Collective

Her major management tool is grouping pupils. For science, pupils are arranged in small groups or pairs. Each group can then cover a different part of the lesson content and share this with the whole class. In this manner she aims to cover a breadth of science content and also to enhance the ability of each pupil to cooperate with others in class, thus providing an opportunity for them all to be successful. Cooperation increases group productivity in

terms of work done in a certain time. Increasing productivity for the class as a whole brings her closer to her goal for them, namely, that of having the larger group achieve success.

In her drive for success, it is necessary to remove individuals who interfere with achievement. She is rather ruthless but fair about this. First she clearly establishes limits for classroom conduct. For example, with a difficult pupil, she claims that he relies on her to establish limits for him. Whatever self restraint he is learning, he learns in her class. Although she tries to capitalize on his brightness and his enthusiasm for science, she will not let him "take hold" and she often has to remind him that she is the teacher. She is really after him to "submerge his [unruly] characteristics and bring these into the group".

Others who cannot conform have to be removed. She explains how this works:

> Alan left. He was preventing things from being done. So he left for a while. I'm very strict about that. John went to the office. That had already been set up. He has a severe behaviour problem. Anna [another pupil] spoke to him. She verbalized that he was preventing them from getting their success. So, then I spoke to him. Anna spoke to him again. He went to the principal's office. He was here after school. As a rule, he has the option of getting back in. But if he is preventing the job from being done, then he loses the privilege of being in.

This pattern she adheres to, for maintaining a productive

environment for the majority of pupils in class. Even when she forms groups, she ensures that "discipline problems aren't together". She readily admits that as the teacher, she is least effective at getting them to work if they are not interested in the task. Grouping accomplishes for her what she cannot easily do with the entire class. Selective grouping remains for her a useful technique for structuring and keeping a productive classroom environment.

She attempts to provide opportunity for all of them to achieve success in her class. Aside from grouping them appropriately, she also uses peer pressure as a powerful tool to manipulate her students into a position of compliance to her will as well as cooperation for their own good. Through her vigorous application of these two techniques, her classroom appears to function as a collective.

As far as she is concerned, pupils will respond more readily to their peers than to her demands. It is also her belief that interchange between pupils is important and desireable. In her own words:

> Some pupils do work that is just neat. Others can help them clarify their ideas, especially when doing experiments, getting results and reaching conclusions. I hope that those kinds of things happen rather than just working on their own--when their own ideas are reinforced. There are definite gains working with someone else. Obviously expectations go up if you are working with someone who is responsible and neat.

Such interaction need not occur only in large groups. She also uses a "peer-tutoring" system quite often. Her inspiration for this system came from some research on the topic that she read. She then decided to try the system. It was difficult for her to manage this at first. Pupils were unwilling to work with others but she persevered and they all now share the rewards:

> I insist that they work together. I take them aside and I say,"Look, I put him with you because I know you can handle this. I wouldn't have given this person to someone else. I couldn't. I know it's frustrating but I know you can do it. Do it." And they do to the best of their ability.... As a result, some kids surprise other kids. Take for example, Nigel, he came in late in the year severely discouraged and learning disabled. A boy like that just working on his own doesn't get anything down. He can't write. He can't see it on the board. But, if he can talk about it, his strengths will come out. Whomever he is working with learns that and they help him get it down. He has great ideas.

She knows her pupils quite well as individuals. Being a generalist and spending most of the school day with them facilitates this level of familiarity. She aims to use her knowledge of their strengths and weaknesses to advance her personal goals of having them achieve success as a group.

Pupils do not work in the same groups all the time. Sometimes they are grouped on a purely mechanical basis. For example, in this unit there were seven body systems and so the 28 pupils were divided into four groups of seven each. It is then her

responsibility to monitor how each group is doing and anticipate and provide them with the assistance required:

> I want to meet with that group in the morning to make sure that they have a fair chance of succeeding in the afternoon. It is a very short time to be ready for me by tomorrow... If they don't want to call on me and they want to work it out, that is fine. But if they're just--nothing is happening, and they are defeated, I'll step in.

Getting pupils to work cooperatively is a difficult goal to achieve. She has been working on this all year, particularly in science and social studies. As she persevered, there was less grumbling from pupils about working with unlikely partners and they settled down to cooperate. In the end it became for her an "excellent system, with less kids staying in after school on their own to finish up. There was more pressure on them to be on task and I guess the pressure came from their peers." Now, she is able to do a unit on the Systems of the Body based on group presentations.

Had they not been prepared, she recognizes that the unit would not have worked. She could not have done this at the beginning of the year; it would have been a "huge failure". Now that students know each other, her chances of succeeding with the method she has chosen for teaching this unit are higher. Had they not been prepared to work as a collective group, this unit would not have worked. They would have experienced little success with

it. She has carefully considered the field of options open to her and finds the best options, even though the choices for her as a generalist are not many.

4.2.2.2. Working with a Colleague

Donna has a longstanding partnership with Dick in teaching social studies and science. Their collaboration in science boosts her feelings of insecurity, of not being "scientific". Their relationship helps her to compensate for the idea she has, that science is the weakest part of her program. It is also convenient for them to work together because their classrooms are across the hall from each other and they have taught the same split grades for a few years. She relates how they work together:

> We normally work together. At the beginning of the year, we propose a plan for social studies and science for the year. We present this to the parents at the first meeting of they year... We have a history of doing this together. I felt that science was the weakest part of my program. We said, when he [Dick] moved across the hall, "Why don't we cut down our work by doing some stuff together. We can get the stuff together and we would have better programs." We both have better science programs and do more science over the last few years because we've worked together. We help each other. We feed on each other and prompt each other.

Their partnership is reciprocal. Each partner contributes a different set of skills. In working together, they discover and share personal strengths and weaknesses:

> I think I'm more concerned with the organization of something, how it is going to go. He is more concerned with the big ideas. I want [to focus on] the management and how the kids will carry through and follow up -- I'm really concerned about that, how they look in books, will they get it -- that they understand how to set up an experiment, really reach conclusions. I'm not saying that is not important to him too. But, I want it followed up and I want to finish it and I want it done well. I put pressure on him. That keeps him on track. It is peer pressure, colleagial pressure. He knows I'm different from him. I know he is different from me. Our strengths and weaknesses support each other's and we help each other.

She thinks that they can draw from each other like this because their relationship is trusting. They have "real trust and a real appreciation for each other's strengths." The bond of trust between them is as strong personally as it is professionally:

> That he could come in and be changing my words as he goes and that's not bothering me at all.... One person is always one step ahead of the other or one step behind and you race over and in a few minutes you talk about how you would have improved it. It is that kind of feedback where one person can admit their human frailty to the other and not feel threatened by that.

Through their partnership, they reflect on and analyze their teaching together, thus providing each other with feedback to which isolated classroom teachers would not normally have access. Being able to share in this type of reflection, even under the press of time, is of considerable value to Donna as a science teacher.

Although Donna's methods of science teaching in class vary

from Dick's, she has the same overall curricular intents. They also have similar goals for teaching the subject. She admits that, "he says when you get down to it, we want the same things but we go about it in a different manner." But she also recognizes the potential that exists for each of them to change direction mid-stream, perhaps on account of their differing personal appreciations of science teaching:

> I feel our objective was much smaller than it has become. Because of his responsibility to cognitive learning, he is making more of it. Really, I think the word "exposure" was very clear in my mind, exposure to the systems.

While their partnership is collaborative in nature, there is ample room for flexibility.

In their collaborative partnership, one teacher tries to measure up to the other. They both recognize and complement each other's strengths and weaknesses. For instance, Donna makes a suggestion or has an idea. She tells it to Dick. He uses the essence of her idea, but changes her words and the context of it to suit his experience and his preferences. That does not bother her at all. One of them is always ahead of the other so that through reflection and communication, the other can refine and improve on what was done. In this way each partner provides the other with a kind of non-threatening feedback, through which they both grow as professionals. As she admits, "it is that kind of

feedback where one person can admit human frailty to another, and not feel threatened by that."

4.2.2.3. Having "Incidental Science"

Aside from the major part of the science program which she designs and implements in collaboration with a partner, she makes up for her not being "scientific" by having what she calls "incidental science" in her class in the mornings at assembly time. Before the schedule of work for the day, the whole class meets with her for about twenty minutes or so. Incidental science emerges from her tendency to run "somewhat of an Integrated Day". An integrated day allows her to bypass rigid timetabling guidelines for teaching subject by subject at particular scheduled times in the day. "If something links up [for the pupils] and it's clicking together, let's say they are using materials and I'm doing some reading, I'll call that Language Arts and Science." For Donna, conventional subject labels have less importance in face of the interests and knowledge which her pupils wish to pursue.

Each day three pupils are responsible for presenting ideas and activities on a certain topic. The topics are science related; Fingernails, Ant Colonies, Architecture, Monkeys, Starlings, Colour. Each pupil has a turn once every three weeks. The group of three is expected to speak to a main idea and to organize the talk around that idea, using a visual aid or experiment or

demonstration with the class. Sometimes, the outcome of the demonstration or experiment is edible and that is alright. But she keeps a record of the topic for each pupil and writes a comment on this "incidental science" activity in each pupil's report card.

It is her feeling that this sort of exercise has prepared them for a more major presentation such as this unit on Body Systems. Also, it enhances their oral language development, which is of considerable importance to her. Furthermore, by integrating science into the regular language arts program, she is finding more time for science, a task which she acknowledges is difficult for any generalist like her.

4.2.2.4. Designing the Content

On three days per week during the weeks that are set aside for science, because they are not doing social studies, science is done for an hour to an hour and a half each day. Pupils are grouped and each group is responsible for presenting information and activities on a system of the human body.

Two weeks before the time to start this unit, she and Dick decided to have a planning session. This time they used the textbook; sometimes they do not use a text at all. First they made up a time line and "put down how much we could get covered in that time." For them the problem is that, with this unit on the systems

of the human body, they have about two weeks in which to cover four systems. This is partly why they decide to have the pupils present to the class an "overview" of the material.

In designing a unit in science, they tend to use a field trip as a "grabber". This field trip is planned long in advance and is usually included in their presentation to the parents. For this unit, the trip is to the Arts, Science and Technology Centre. However, they were disappointed with the way this visit went. Pupils had an opportunity to view demonstrations and displays of the systems of the body. However, there was little explanation offered to pupils on the actual systems and their questions were not appropriately answered. They agreed that there was little the teachers could do to guarantee the usefulness of the field trip experience, beyond what they had actually done in this case. Nevertheless, by providing each pupil with a worksheet on the displays seen and discussing those sheets in class, they hoped to compensate.

For Dick and Donna the process of designing their science program is one that evolves. They begin with a "desire to free ourselves from the curriculum in science and socials and do more or less, what we want and by that, I mean, following the pupils' interests, our interests." With this commitment, they then follow up on the topic, which was chosen earlier on in the year. Usually,

there is a balance between biological, physical and earth science topics throughout the year. Resources are brought in and the unit is designed around the resources and the field trip:

> The science program has changed from last year to this year. I think our planning has become clarified because we really learned to do it, or because I learned how to do it in the course of designing a curriculum in social studies. Having to present that to teachers gave me a lot of time to think about it. I now know from the ground up, how to design a curriculum whereas before, I used to rely on Dick to get the momentum going. If I don't work with him next year, I know how to do it. I'm worried about how I will find the time, though.

For Donna, this unit has changed considerably from plan to practice. She thinks that when they first talked of this unit, they conceived of an overview of the systems of the human body. Partly because of the enthusiasm of the pupils and because of her partner's commitment to cognitive intents, she thinks that the unit has grown to be more substantial. But, this unit has worked well for her. Her class was accustomed to working together in groups, to presenting information orally and demonstrating their ideas experimentally or visually. This unit was no different. She ran around from group to group modelling what was to be done, ensuring that they were on target, removing obstacles and manipulating them into achieving and demonstrating success. For her, the payoff was the excitement and the enthusiasm of her pupils in the course of their doing this unit.

TABLE 4.3

TEACHER APPRECIATIVE SYSTEM - JACK

PROFESSIONAL IDENTITY

AS DILETTANTE

a teacher's style is a teacher's style, regardless of the subject

liking science is the key to good science teaching

having a definite approach to science teaching that is not text-bound

no teacher is totally unique; teaching is borrowing ideas

being able to generate one's own keenness and enthusiasm for science

liking science and finding it easier than most other subjects

BEING A SPECIALIST

liking the idea of being able to specialize in science

difficult to teach all subjects and teach science well

not teaching social studies and therefore having more energy to teach science

knowing enough to get along without the text

having previously taught all his pupils science in the former grade

PREFERENCES FOR PRACTICE

PROVIDING VARIETY

seeing the program as a "smorgasbord" of offerings in various fields of science over four years

having a four year program allows the teacher more variety

wanting to cover topics in depth

fulfilling pupils' curiosity in science

catering to pupils' need for variety

helping pupils to arrive at the "right balance" in their learning of science

experimentation is the key

looking at science differently from other subjects

Table 4.3 (contd.)

changing things during the year because what works with one group of pupils does not work with another

over the years, "weeding out" what does not work

WORKING WITH A COLLEAGUE

having a similar approach to the teaching of science as his colleague

borrowing from his colleague and adding to it if he likes it

sharing and improving on each other's ideas

helping each other with equipment

deciding cut-off points by grade or program content

feeling that working with a partner enriches the program by blending ideas

keeping in touch all the time

CODESIGNING THE CONTENT

making tests together

setting up the program, negotiating limits for pupils, grade levels and determining content

deciding on things like how many marks something is worth and what to deduct marks for

knowing "in the back of our head where we are going and just doing the fine tuning"

not having the same program without any one of them

developing personal teacher and pupil interests in science

## 4.3. Teacher Appreciative System - JACK

### 4.3.1. Professional Identity

#### 4.3.1.1. As Dilettante

Jack likes science and therefore he enjoys teaching it. His mission is to subvert his pupils so that they too have the same enthusiasm for the subject that he has. He is also confident that his store of scientific knowledge is more than adequate and therefore he does not hesitate to use his interest and background in science to extend his pupils. This approach is particularly apt for students at a school with what he perceives to be an "academic orientation".

He readily admits that while many teachers may teach the same material, each teacher has a unique approach:

> I guess what I'm saying is that I put my personality into teaching. I present it the way I am comfortable with it. For example, take Teacher A and Teacher B, they are both going to light a bulb. The kids are basically the same but each teacher says it differently and the kids react to the personality.

As a professional, in his eyes he stands out because of his strong liking for the subject which evidently colours his views of the subject and the goals he seeks to accomplish in teaching

science at the intermediate grades:

> My main objective is to show that science can be looked at in a totally different way from the other academic subjects. I think the whole idea is that when a pupil says he has had science, he associates something different with it than just another textbook and another assignment. Science is not just language arts or social studies. It is a subject where you learn by experimentation and interaction with other pupils.

Yet he also sees himself as a designer, one who enjoys finding scientific ideas and using them to create an exciting program. For him, "teachers are great stealers of ideas. All [his] ideas come from somewhere else." All that is unique about teaching is the teacher's style which persists regardless of the subject being taught. Science is special to him, though, because he likes the subject and wants to teach it:

> I guess I like the subject. That's the key thing. I'm more involved in it because I'm interested. If you like something, you put more time into it. The task is never hard if you like it.... I've always liked science and I enjoy teaching science. Because of that I work harder at it and I show I like it. I think pupils pick up the vibrations that I like what I'm doing. They are also good the other way...to pick up something I'm really resisting. It really goes back to interest.

Because he likes science, he wants to teach science and this liking and wanting influences how he teaches the subject to his pupils and how as a result, they perceive the subject itself.

4.3.1.2. Being a Specialist

He is also in the fortunate position of not having to devote time and energy to teaching subjects for which he does not have a similarly strong commitment. He does not teach subjects such as physical education and social studies. As he explains:

> You see, now I don't teach social studies, so the extra energy I can put into science. But if I had to teach both, with a split class, I know that I'd really be swamped.

Furthermore, the "platooning" at his school enables him to be a science "specialist". He can therefore pursue his own interests and his pupils' interests in science. It is more advantageous for him to be a specialist teacher of science rather than for him to be a generalist. As science teachers of the intermediate grades, he can say of himself and his colleague:

> We're in a unique situation. There are two of us teaching all the intermediate science. The two of us plan everything from grade four to grade seven. So, instantly, that gives us the whole run of the entire curriculum at any level at any time.

### 4.3.2. Preferences for Practice

#### 4.3.2.1. Providing Variety

As a science teacher, he feels that it is his job to maintain the interest and enthusiasm of his pupils for the subject by offering them variety. The variety he can provide for them in science he cannot, in other subjects:

> I guess I see it just as variety. I teach math and math is basically seatwork. Language Arts is basically seatwork. So, to me science is a whole different world; it's my chance to do something different. I see the other stuff as quietly going through page by page of a textbook. I see science as a total escape from that. It is "hands-on" with variety. It's not structured. I don't have to start on page one and go on.... It's just a totally different approach to a subject.

Yet, even for a professional like him, with the bright ideas and the liking of the subject, finding the right balance through which to provide "variety" in the subject is perplexing. This is what he says:

> If you spend too long on one topic, eventually you lose interest. And I think if you spend too little, then you don't get as much out of it as you can. So, it's a matter of at what point in the year you feel that they have had as much as they need and then you push on to the next topic...

It is not his aim merely to cover a variety of topics. Because of his view of the subject, he thinks he ought to be

able to use science to match pupils' curiosity and in so doing, help them develop thoughtful ways of dealing with uncertainty:

> Answers aren't always there in science. In another subject, you would go to the textbook and there is an answer on a certin page and you give that back to the teacher. With me, I'm giving them the material, some of which there is no answer for around them. They have to find an answer through discussion. Or, I may say there isn't any one answer. Maybe they have to think up a reason for that.

In order to fulfill his personal goals and expectations for pupils, they have to be able to use appropriate thinking strategies. He claims that they actually find it difficult to "think". They seem to go so far in their thinking and then they stop and look for a clue or an indication of further direction. He sees himself as the one to urge them on so that they can define precisely just what their conclusions are and how these have emerged from their observations. For him, science is the appropriate ground for redressing this disability. He presents puzzles in science class. His pupils are encouraged to solve these practical puzzles without any input from him. Then he seeks their solutions and by skillful, probing questions, he leads them to evaluate their own solutions and recognize other plausible ones.

4.3.2.2. Working with a Colleague

While the program has evolved since he came to that school, he

readily admits that it is far more difficult to initiate a worthwhile program than it is to maintain one. He was not the teacher to initiate this program. His colleague did. She was at that school before him. But he is now involved in shaping and extending the program. He now shares in designing units within the program but acknowledges that some of the ground rules were originally laid down by his colleague.

However, their goals are compatible because they have a similar approach to the teaching of science. They monitor each other, share ideas, equipment and tests when appropriate. Indeed, their partnership is not competitive; it is collaborative. They create the program together. They share the teaching of the program. The two of them manage the teaching of all the science from grades four to seven at that school. The school has an academic orientation, with a tradition of a "strong science program"; he sees himself as upholding, constructing and shaping this tradition, through his science teaching.

4.3.2.3. Co-designing the Content

Both Jack and his colleague, Jessica, work very closely to design the content of the units and lessons they teach. But his ideas for lessons come from various sources, Jack admits and both teachers share in these:

> I'm very open to ideas from others, from various sources. I've done photograms in the darkroom with pupils and one of them asked me what would happen if I put Lugol's solution in. I told him to try it. Somebody else wanted to tie-dye and we made coloured photograms. They were fantastic. I asked Jessica if she had ever tried colour. She tried it and her kids loved it.

His personal interests also colour what he chooses to teach and how it is taught. In this respect, he carries the job of science teacher far beyond the limit of the classroom into his own personal life. This is not unusual for him:

> Travel is one of my interests. My wife is the same and she is a teacher too. So, we're always picking up things. For instance, now I'm teaching dams in B.C. I went to see the W.A.C. Bennett dam. I went there because it was in the science program and I was around there anyway. It was on my route. Now that I've gone there, I'm even more enthusiastic about teaching about dams. So I guess I take my experiences and integrate them into my teaching.... We were doing volcanoes, recently. When I passed out to the class, the photos of Mt. Saint Helens that I had taken when I was there, I could see they were more interested. So, it's experience, sharing experience...

Jack and Jessica plan the science program together. Together they monitor it and they also have similar standards for teaching. Yet these collaborative efforts cannot guarantee how things are likely to "work" in each teacher's class:

> When I teach something the first time I have a certain expectation of how it ought to go but I never know how it is going to go until I actually do it. After it is done, I turn around and say to myself that maybe I should have done this or that differently, or this a bit earlier. I think you have to look at the ability of the

TABLE 4.4

TEACHER APPRECIATIVE SYSTEM - JESSICA

PROFESSIONAL IDENTITY

A "SEAT OF THE PANTS" STYLE

wanting to get somewhere and knowing where and being willing to change to get there

not teaching exactly as she did four years ago

always on the "look-out" for ideas

others do not see what does not work; it is thrown out

not feeling that I know much science

no hesitation in saying to pupils, "I don't know"

planning in mind a lesson which is no where near what really happens in calss

going with what comes up; even a digression

having definite ideas about want is appropriate

having fun in science

feeling that "you are first of all a teacher and that the style goes with you, regardless of the subject"

important to conceive of how something could work

increasing expectations each year

BEING A PROFESSIONAL

teaching science for about nine years

giving workshops for other teachers of science

applying ideas from workshops in class

being considered "science expert" by the staff

compensating for "what you are uncomfortable with"

building traditions that new pupils have to accept

Table 4.4 (contd.)

PREFERENCES FOR PRACTICE

MOVING THE CLASSROOM OUTDOORS

recognizing the limitations of texts

essential to have equipment to design a unit

using the environment as a resource for unit design

always looking for resources that are "hands-on", interesting, good for the pupils and that "fit into science"

devising activities that involve working out of doors for science

having a making equipment for outdoor activities

using the beach "as a classroom"

PUPILS AS CO-INVESTIGATORS

being flexible enough to follow pupils' interests and directions

having a wide range of classroom activities, discussions, presentation, writing and "hands-on" activities in science

feeling that children are happy if they know "X" and can do it well, therefore an academic orientation is uppermost

often feeling that the pupils know more than the teacher

getting pupils to analyze their own work without being defensive

doing things purposely to get pupils thinking and questioning

wanting pupils to like science and wanting to "turn them on to" science

being prepared to "go on forever" with a pupil who is "off-the-mark"

allowing pupils to get their own recognition through speeches, apart from tests

providing pupils with a variety of ways of working in science

WORKING WITH A COLLEAGUE

seeing a partner as someone she could get along with and someone who likes science

Table 4.4 (contd.)

helping each other find ways of doing good units and with the least "wear and tear"

needing to work with someone who likes science

stimulating each other

getting together to plan a review and changing the previous year's preview to start

working out some very good lessons, talking about them and throwing away the parts that don't seem workable

trying out and improving on each other's ideas

pupils think of them as a team, a "unit"

watching him "work out the logistics" with a new unit and making a lot of her own modifications

> kids too. I can give a test one year and the kids can handle it but not another year... The way I discipline, little things that I do during the year, change because what works well with one group doesn't with another.

The content of the science program is therefore not static but dynamic, changing from grade to grade, from year to year and from class to class, with personal interests of the teacher and with circumstance.

## 4.4. Teacher Appreciative System - JESSICA

### 4.4.1. Professional Identity

#### 4.4.1.1. A "Seat of the Pants" Style

Jessica describes herself as having a "seat of the pants" style. While this is her attempt to focus on the improvisational nature of her teaching practice, it also characterizes the creative spark with which she ekes the best out of a teaching moment for her pupils. She has had several years teaching science, many of them at that same school and she also lives in the neighbourhood. Although she humbly admits that she does not know much science, it is hard to imagine a teacher with more drive, enthusiasm and practical knowledge about her work.

She wants all round excellence from her pupils, not inconsistent with the "academic orientation" of her school. This

means that whatever she undertakes to do with pupils, she expects them to do to the very best. One of the highlights of her science program is a series of talks or speeches which the grades six and seven present in the latter part of the school year. The idea of having pupils become adept at presenting information orally, came out of a personal experience she had some time ago:

> I started this because I went to a political meeting and I noticed that the only people who stood up were people with British accents. I asked myself what it was about a country whose people would not stand up and speak in public. I immediately came back to the classroom and started formal speeches. It started in grade seven and we have used it and used it.... The funny thing is that I had a grade eleven pupil come back and he said that he had had me for grade four, five, six and seven science and that he couldn't remember a single thing that we had studied in science. But he remembered doing two talks in grade seven and that had carried him through school. He told me that was the best thing I had ever done in science.

The speeches that her pupils prepare and deliver have become a part of her science program that is valued highly by the students themselves and by her too. Other aspects of the program also relate to these speeches. Research skills become important and pupils learn to write up a bibliography, take notes and deliver an oral presentation from their notes without memorization.

She has set for herself and her pupils goals that are wide-ranging. They encompass much more than a focus on the content

of science curriculum. Perhaps this is because she sees herself to have a role that is wider than that of a mere provider of science curriculum content.

The pupil who leaves her class must have the potential to be a well-rounded, productive citizen. She is there to facilitate this kind of personal development in her pupils. Science is a fertile medium through which she can realize these motives and she is pleased to say that her pupils themselves recognize and applaud her goals for them.

4.4.1.2. Being a Professional

The "seat of the pants style" that she humbly ascribes to herself is a deceptively casual expression of her own carefully thought out agenda for science teaching, at the intermediate level. This agenda reflects appreciations of her professional identity that are many-sided. To her, elementary schooling is an important preparatory step, not only for secondary school, but for life. Therefore elementary science is not just "play", as secondary teachers might say. It is the medium through which her pupils learn to explore their worlds, to confront meaningful environmental issues of the day, to frame questions and seek for themselves relevant answers. She would have them do all of these things in her science classes and her role is moulded by these ambitions.

She is humble about her subject knowledge but she thinks that her knowledge of the discipline enables her to feel comfortable with the subject, even when she is being innovative:

> I figure to be a science teacher, you should know a fair amount of science to be comfortable with it. I think that is a problem with most elementary teachers. They are not comfortable with the subject because they have not had any science. I know to myself that I have had one year of Chemistry and one year of Zoology in university. Certainly, that is enough to carry me through. But if you haven't even had that much, I would think you would feel as I feel about physics, inadequate... We probably lean more to Biology. But we carefully try to put in some physics, some chemistry and some astronomy -- very conscious about balancing the needs of our pupils.

She herself would like to have a more extensive knowledge of the disciplines within science. She misses no opportunity for her own professional development. She attends workshops for that purpose and the information and ideas she gets from them are played out in her teaching:

> Certainly I love workshops. The Science Symposium has contributed to the classroom in so many ways, as well as other workshops and professional days. The professional days have added a lot to my career. What other way is there to get new ideas? ... This school is very strong. We sit in the staffroom and we talk over everything.

In pursuing her own growth, she misses no opportunity to incorporate other interests and information into her teaching of science. Often, this means that her search for ideas extends

beyond the school:

> Oh, I heard a tape by the Workmen's Compensation Board. It had something to do with the ear. I came back to school and I told Jack about it. We had to do the ear so we decided to use that as a base. We keep our "feelers" out for good, hands-on, interesting material that suits the age level and fits into science. We feel that the textbook provides a lot of scope. I remember having a principal who said that whatever I do, I should be able to justify it. We always find something in the book that says that what we're doing is elementary science.

Yet, it has not been easy for her to gauge the professional status of her own teaching. She laments the isolation and uncertainty of her early years. For years she worked alone in her room, not really knowing how she was doing:

> I'm not doing anything differently really, from what I was doing before when I was so worried whether it was o.k. I imagine there are a lot of teachers who might be doing good jobs who don't know it.

Now, after nine years, she has a well-articulated view of her own professional competence. She knows that she is doing a good job of science teaching.

4.4.2. Preferences for Practice

4.4.2.1. Moving the Classroom Outdoors

She encourages pupils to use the environment outdoors as

their learning ground for science. Often, their investigations progress outside of the classroom to the schoolyard:

> One year I had the pupils bring coat hangers and nylon stockings and we made nets and they're still here. We'd go down (to the beach nearby) and dig in the mud and see what we find. Now we're planning a unit on Orienteering. We'll teach them map reading and plant identification together. I'll go down before school and I'll put up fluorescent stickers with numbers. Pupils have to take the map, read the map, find the sticker and identify the plant.

Again, she recounts how on one occasion the grade fives were doing with her a unit on measurement in science. They had to move to that part of the schoolyard outside of their room to do some measurements. A group of pupils needed to verify a claim that some of their peers had made. She was, of course, enthused at their commitment and intrigued by the challenge. The class went along and they did a number of measuring activities outside in teams. Another teacher at the school complained of the "noise". She was indignant. How could pupils be expected to pursue learning that was spontaneous and relevant to their interests, in silence. To capitalize on the rare moments of excitement in learning is important to her. For this she would risk admonishment from her peers.

4.4.2.2. Pupils as Co-investigators

Jessica's view of her role as a teacher is critical to her interaction with pupils. She is the one who anticipates issues and questions of interest to students and introduces these into her classroom, in an atmosphere which allows pupils to pursue discussion and search for their own answers. With her gentle guidance and open-mindedness, they all engage in an enjoyable search for the knowledge they want, she with them. But she is also there to keep them on track, quietly encouraging and supporting them as they work towards personal excellence. She is there to stimulate and to facilitate as much learning as her pupils can accommodate. This is how she talks about her science teaching:

> It's fun and I like doing the activities because they're fun. I like discussing plate-tectonics and ecology and saving the environment with them and how we solve these problems. That to me is the bonus of the job. I have definite ideas about what is appropriate or not; they may not be all that clear-cut to the kids...

It is her style to "go with the flow" and let her pupils benefit from the pursuit of their own interests, with her guidance to extend them. Science seems to her the right "breeding ground" for this type of interaction. Yet, she appreciates that following personal directions contributes not only to their knowledge but also to her own professional growth in the subject:

> I have no hesitation in saying to the children, "Let's find out" or [admitting] that they know more than I do. And, I feel I'm learning all the time. If I get interested in an area, it ends up in the unit because if I'm going to do the reading and work, I have to do it for my own interest, to learn something. Then I'm excited enough to share it and that may be another unit. That is how a lot of units get started. For example, I live in this area and I was so excited when Jericho was turned over to the city, I started wandering through it and thinking out how I could use it as a classroom.

Allowing pupils to head in their own directions does not lessen her responsibility to provide them with interesting avenues for learning about science. Her own interests too are woven into that fabric for learning science. She uses as wide a range of material and events for science instruction as she can, dedicating herself to the task of maintaining the excitement of personal discovery for herself and her pupils, open to improvement and change:

> I know I want to get somewhere and I know where I want to get and I'm willing to change to get there. I can't say that this year I'll teach exactly as I taught four years ago or that in four years I'll be doing what I'm doing now because I may still be doing what I'm doing now because I may still have the same goal--but I may also have changed.

In keeping with her desire to enhance her own personal and professional growth in the subject as well as that of her pupils, she encourages them to take the responsibility to join with her in the pursuit of their scientific knowledge. But she also takes into account their own needs:

> I would say that I'm trying to be sensitive to the pupils to the point where, if I felt that their interests were leading them somewhere worthwhile, that I could go off in that direction. I would not be so rigid that I would aim for point B, no matter what. So, very often I plan in my mind a lesson and then it is no where near to the lesson that actually happens in the classroom. If there is a discussion that comes up and I think it is a learning experience--it may be a different topic; it may be a digression; it may be something I would have taught another time--I will try to capitalize on their interests, on their knowledge. I see it as a willingness to go in directions you didn't plan but they are keen to learn and science is quite conducive to that.

By the same token, she insists that they all meet the demands that she sets for them. This is part of her wanting them to "take responsibility for themselves and their work" but also to gain status and build confidence in themselves. She explains, for example, that at first not all students were enthusiastic to present their speeches:

> I still have some [pupils] to go. There is one girl who does not like doing speeches. She tried it and it was one sentence, one sentence, one sentence. And the class just said that was not acceptable; one and a half minutes was not a speech. I did not have to say anything. The kids just said that. So, I then said that there would have to be a two minute talk and the group would have their diagrams and the talk prepared. Then, they were going to come up to the standard of everyone else. The one girl who gave the talk said that she hated giving speeches. She has been up twice. She does not have enough material. She got 47/50 on her exam. She is my best reader. She wants to take a 0/10 on this because she sees a very low value for this. I'm prepared to go on forever.

Her demands of pupils are stringent but consistent and she is prepared to work along with them towards their goals. The program of science is wide-ranging in content and in strategies for communicating that content. Even when pupils are presenting their own material, the atmosphere is one of questioning and tolerance for many viewpoints. Few questions come from the teacher; the action is played out around her, almost as though she were a player herself. Occasionally, they look to her to resolve a dispute. In her classes, learning is happening and they are all participating in that happening:

> I don't think it is accidental. I do some of these things on purpose, to get them questioning and thinking. I mean I'm trying to get a thinking productive citizen. If you're thinking about it in grade four, fish ladders versus damming a river versus no fish or whatever, you'll always think about things. Thinking, that's the name of the game.

Hers is to nurture not only to provide; to facilitate not merely to control; to develop a whole person, seeing science as the tool and opportunity for achieving these ends.

4.4.2.3. Working with a Colleague

It is clear that she recognizes the professional strengths of her colleague. They share programming and designing content and activities of science. They also have a similar approach to the teaching of science, which makes this collaboration possible. They

are both keen and excited about science personally, wanting to pursue their own interests in the subject in the course of their teaching. For both of them the subject seems conducive to discussion of issues and experimentation.

Each year, she prepares plans for the coming year. As well, she carries throughout the year an intuitive sense of the extent to which these can be modified, adjusted or extended to include the magic moments that emerge in class out of her own interest in pursuing pupils' directions. Because of her "seat of the pants style", any partnership she engages in has the potential to be somewhat confining for her. Yet, in her readiness to "try out" new ideas, her main criterion for a partner is "anyone I could get along with, somebody who likes science and wasn't doing it because it is a job, who by choice, would go to the Science Symposium and lectures and like to read about scientific things, somebody who was really keen." Consequently she and Jack share ideas, techniques and experiences through which they enrich the content of the program for the beneficiaries of it, their pupils. This is how she appreciates their relationship:

> We're helping each other find ways of doing good units at the least expense and "wear and tear" also... I think that's what teaching is. Somebody keen on a subject or area fires up somebody else. We tend to stimulate each other.

## 4.5. Chapter Summary

In this chapter there are four descriptions, each one focussing on the way in which one of the four teachers in this study appreciated practice. These descriptions of teacher appreciative systems are themselves narratives which portray each teachers' appreciations. Each narrative is organized around the key elements, which appear to characterize a teacher's science teaching. It is important to mention here that the narratives are intended to present the reader with a flavour of the distinctness of a teacher's appreciative system as well as to allude to the practical considerations around which a teacher's appreciations coalesce. The descriptions in this chapter, therefore, are presented in response to the first set of research questions on the nature of teachers' appreciations of their practice.

The following chapter, seeks to respond to the second set of research questions of this study. In Chapter 5, teachers' appreciative systems are compared but this is done through the medium of one key appreciation common to the sample of teachers, collaboration. It was observed in the study that each teacher voluntarily sought out and developed a working relationship with a colleague in the same school, in order to teach science. What follows is an exploration and analysis of teachers' collaborative relationships with each other in the light of the comparability of their appreciations of elementary science teaching practice.

# CHAPTER 5

# COMPARABILITY OF TEACHERS' APPRECIATIONS: THE NATURE OF TEACHER COLLABORATION

## 5.0. Introduction

The general intent of this study has been to portray what it was like for four teachers to teach elementary science. The teacher appreciative system has been used as a construct for depicting key features of an elementary teacher's science teaching practice. Individual appreciative systems of each of the four teachers in the study were described in response to the first set of research questions. The resulting narratives were presented in the previous chapter to provide the reader with snapshots of those teachers' appreciations of their practice. The second group of research questions sought to investigate the extent to which teacher appreciative systems were comparable. In response to the latter set of research questions, this chapter will dwell on the comparability of teacher appreciative systems. However, this discussion is anchored in the common theme of teacher collaboration which has emerged from this comparison of teacher appreciative systems.

## 5.1. Predominance of Teacher Collaboration

This has been an inquiry into the nature of the practice of teaching elementary science. Examination of teachers' appreciative systems revealed that these teachers shared a common preference for working along with a colleague in science teaching. In the study, this preference has been called teacher collaboration, underscoring the fact that each teacher sampled, happened to have voluntarily chosen to work with another teacher in the teaching of science. It is important to mention that in the course of their collaboration, the teachers maintained regular timetables and responsibilities for science teaching in their own classrooms. They were not team teaching; their work relationships can aptly be defined in this dissertation as "collaboration".

Through collaboration, teachers reflected their own appreciations of reality. Yet, despite the common preference to work with a colleague in teaching of science, each of the two instances of teacher collaboration between the four teachers in the study seemed distinctive in character. In this chapter, teacher appreciative systems are compared by referring to the individual teacher appreciations described in the previous chapter and examining these specifically in light of the nature of the collaborative relationship in which each pair of teachers engaged. The chapter therefore addresses the comparability of teachers'

Table 5.1 Comparison of Key Appreciations of Collaborating Teachers

| Dick and Donna | Jack and Jessica |
|---|---|
| **Individual or Group** | **Leading and Following** |
| Dick: focussing on pupil individuality<br>Donna: providing for success of the group of pupils | wanting to "do more science"<br>following each other's lead |
| **The "Concrete" and the "Abstract"** | **Cooperative Program Design** |
| Donna: seeing limits and "narrowing the focus"<br>Dick: striving for all pupils to have certain "scientific" knowledge | planning a four-year program together<br>aiming for excellence and diversity in programming |
| **Mastery and Coverage** | **Mastery and Coverage** |
| both exchanging expertise and knowledge of science to enhance instruction | demanding more of pupils than mere knowledge and skills of science |
| **Reciprocity and Compromise** | **Compatibility and Style** |
| jointly anticipating and working on units and lessons<br>jointly reflecting and working out differences in practice<br>giving and getting non-threatening, constructive feedback | recognizing each other's strengths and needs<br>having flexibility and tolerance |
| **Curricular Autonomy** | **Curricular Autonomy** |
| operating as "design professionals"<br>working as a team | maintaining independent curricular decisions<br>working as a team of "experts" |

appreciative systems by examining the nature of teachers' collaboration in science teaching, as illustrated by the four teachers who took part in this study.

## 5.2. Nature of Teacher Collaboration: Synergy or Cooperation

The descriptions of practice in Chapter 4 indicate that, while teachers had similar perceptions of science teaching, their appreciations were distinct in certain crucial aspects. This warrants special mention of the way in which pairs of teachers dealt with each other, the nature of appreciations expressed for each other and the influence of these on the dynamic which characterized their interaction in science teaching.

The collaborative relationship which Dick and Donna shared, bore earmarks of being different from that which Jack and Jessica shared. Considering the uniqueness of each teacher's appreciative system, as described in Chapter 4, it is not surprising that the manner in which a pair of teachers related with each other at their school was distinct. Dick and Donna's partnership has therefore been characterized as synergy, while the nature of interaction between Jack and Jessica is better described as cooperation.

Dick and Donna have quite differing appreciations of elementary science teaching. For instance, Dick's practice is

dominated by his "individualized style". Donna, on the other hand, aims for individual pupils to submerge [unruly] characteristics and bring these into the group." Such dissimilar commitments have not prevented them from having a productive and enjoyable partnership. Indeed, each teacher brings to their collaboration contrasting appreciations which are themselves responsible for the form of teacher collaboration existing between that pair of teachers. Teacher collaboration is characterized by a tension to which each teacher contributes, based on personal appreciations. What emerges is a reciprocal, dynamic relationship in which each teacher gives and each benefits. Donna herself has aptly described the synergistic nature of their partnership when she said in Chapter 4, "We help each other. We feed on each other and prompt each other." And Dick has agreed that, "When we work together, we certainly feel as though the ideas I have are being used more broadly.... I do measure myself against Donna, perhaps more than I should...."

Jack and Jessica also collaborate, but their alliance is recognizable for its cooperative nature. In Jessica's words, "We're helping each other find ways of doing good units at the least expense and "wear and tear".... We tend to stimulate each other (Chapter 4).

From the discussion of teacher appreciations in the previous chapter, particularly from the descriptions of each teacher's

preference for "Working with a Colleague", the flavour of teacher collaboration in each pair of teachers has certain remarkable features. Dick and Donna's relations reflect reciprocity; Jack and Jessica's, easy compatibility. The rest of this chapter attempts to illustrate and substantiate this position by describing how the nature of Dick and Donna's collaboration can be seen as synergy and how Jack and Jessica's relationship functions as cooperation.

## 5.3. Collaboration as Synergy: DICK AND DONNA

### 5.3.1. Individual or Group

Dick and Donna work together to design instruction in science. Yet, as mentioned in the previous chapter, they seem to differ in their personal views of themselves as science teachers. For Dick, it is important to foster the cognitive development of each individual pupil in his class. He himself says, "I often think of my major driving force as being what I want to get over to the kids..." With his focus on pupil individuality, this tends to be achieved at the expense of efforts to develop the cohesiveness of his class as a group. He readily admits:

> I could think more carefully how I manage situations. For example, it never occurred to me to clean up the way that Donna cleans up. [And again,]... I do find it harder to get Ken to do what everyone else is doing when I know he will find it hard to do what everyone else is doing! And that undermines everything in a way. I mean I know.

Donna, on the other hand, sees herself as a provider of opportunities for success for the group of pupils in her class. Therefore she promotes group activities and uses peer pressure to ensure that expressions of extreme individuality are "submerged and brought into the group", thus affording each person in class an equal opportunity to contribute to the success of the class as a whole:

> At the beginning of the year I start... and they become more homogeneous in that sense. I have a certain level of behaviour that I expect <u>everybody</u> to reach...

Dick is concerned that each of his students "knows something scientific". They need to know as much of the content of science as they can hold. Their written work should reflect what they know. But, in marking their work, he does not apply the same standard to all of his students. Though he aims for them all to "know" science, he makes allowances for their individual abilities:

> I'm aware that I would perhaps give a "C" to Jane; and I might give a "C+" to Pam that might only be a "C" for Jane... But my reaction to their papers [worksheets] and the feeling I want them all to have when the paper comes back with my mark on it, is a reflection of the ability they have and what they've actually achieved.

His criteria for marking are based on his own judgement of each student's personal ability and progress, rather than some

hypothetical average for the whole class. He expects his marks to reflect a pupil's actual ability and achievement. Indeed, he concedes that he would mark some pupils "very good" on work that might well be marked "poor" for others.

Donna recognizes the pupils in her class through their identification with the larger group in which they operate. She works at raising standards for the class, expecting each individual to measure up to group standards for behaviour and cognitive achievement. She works at getting them to progress as a group. They help each other to improve and as the class moves ahead, each pupil shares the pride and the success of the group.

Dick and Donna recognize and acknowledge their differing appreciations of practice. This excerpt of one of their conversations reflects how, in their collaboration, each accommodates to the other's position:

> Donna: I think it's the dilemma of the group versus the individual. I would see it that way. I'm holding both. If the Circulatory System has to be done, the group has to find a way to make that happen and I do praise the group for having done it.
> Dick: I find that really interesting because I've always felt that your classes are more coherent and I've attributed that to a number of things. I've attributed that to your style. I think you love working on getting the group together. You do the "student of the week" and I think you do, at the end of the day, bring everyone together and you have a nice ending to each day.
> Donna: We're different, very different. I appreciate the differences. You're seeing what I'm missing. Hopefully, I'm doing something that you appreciate. And you do tell me.

Despite these inherently different personal appreciations of their professional roles, Dick and Donna have an effective, reciprocal professional relationship. In the teaching of science, they complement each other. Donna sees the whole; Dick focusses on the parts. Donna emphasizes method; Dick, content. Donna has long range vision, seeing how a lesson will contribute to the success of the whole unit and managing the lesson to fit into overall intents for the unit:

> Interviewer: But, when you conceived of this unit, what was it that you intended to happen?
> Dick: Well, I had got these cognitive goals in my mind.
> Donna: And I'm feeling quite differently. I feel that our primary objective when we started, given the amount of time we had, was to give the kids an exposure to these four systems... I feel our objective was much smaller than it has now become. Because of your responsibility to cognitive learning, you are now making more of it. Really, I think the word "exposure" was very clear in my mind. We could have rethought that ... but I think that was our goal. And if you look at this, that certainly is substantiated.

Dick wants to perfect each lesson, concentrating on how it will work for him and for certain pupils in the short run. Donna's practice seems to be driven by general, long term goals for the unit and for class success. Dick, operating lesson by lesson, tries to vary the lesson to suit individual pupil needs and in so doing, his own vision of class accomplishment dims and his long range hopes for the unit become remote. Consequently, he experiences more frustration than Donna, often feeling that he is

not accomplishing as much as he had hoped. She recognizes that he has a tendency to be overly critical of his own performance. While reflecting on the unit and its progress, they exchange views, each attempting to explain and justify personal appreciations of their practice. Through this dialogue, their relationship helps Dick to objectify his view of his competence, enabling him to be less idealistic and to take more account of the practical limits of his position.

### 5.3.2. "Concrete" or "Abstract"

Although Donna aims for success for the class by the end of the unit, she continually looks for concrete indications of that success and measures her own progress in small increments. She is pragmatic about the breadth of work she can handle. Recalling how they planned the unit, she says, "I guess I was thinking in the amount of time, what could be, how much could really be accomplished." She sees her limits, narrows the focus of what she can do, and draws reinforcement for her subsequent steps from small gains she makes along the way.

Teachers such as Donna who see themselves moving between the many concrete, day-to-day demands that mark science teaching as only one of the many jobs they must do, seem to count their achievements in the short term. Perhaps they maintain self-esteem by acknowledging the small steps they make along the long road to

the success they seek. Donna sees it as her task to bring the whole class success. She concentrates on moving them along together and casts aside with fierce determination any resistance to that goal, which they themselves as individuals may offer. She pats herself on the back, so to speak, when she makes a small gain:

> There's a variety--like your kids, there's a variety of levels of commitment to reading the text. But I'm reacting to [their] getting involved in the material... Kids have been staying in after school, whipping up experiments. They're using words that they've never used before, a vocabulary they've never had... It isn't exactly what we set out to do, but it's very exciting, what's going on.

In measuring her professional gains, she acknowledges the limits or constraints of her teaching situation. But because she reflects on what she accomplishes step by step along the way, in the short run, she finds the fuel to energize further activity and so she maintains self-esteem and a healthy professional outlook.

Yet, the limits of her position are nevertheless real. She does not have much "specialist" knowledge of science and as a "generalist" teacher, neither does she have unlimited time for any subject, even science:

> I tell the kids, "I don't know. Go to the library. Go to the library and find out and tell me." So, that's the base. If they're going to do the Circulatory System, I'd put the book by my bed and read it the night before... It is anxiety producing but it's all I can do in my busy

> life as a teacher. I don't know it all and I feel stronger in other areas.

But, as mentioned in the previous chapter, she compensates for these personal drawbacks by exposing students to a breadth of practical, scientific ideas in what she calls "incidental science". She concedes that she does not hold all the content herself; she concentrates on motivating students to search out scientific knowledge themselves and works along with them as they search.

On the other hand, Dick is an idealist. His scientific knowledge base dictates for him what his pupils ought to know in science. He concentrates on delivering this information to them, emphasizing what is commonly called "the scientific method" of doing and writing up experiments. He strives to have his own idealistic goals achieved by each student in his class, within the confines of pupils' individual abilities.

As any practitioner would, Dick experiences minor setbacks in his practice:

> It has turned into something else, so that I did not have these other goals in mind... I'm sure they'll come out with the information. It's just that I don't see it there yet. That's why I say I'm halfway down the tunnel.

Yet, he pursues his vision of individualization and cognitive

achievement, apparently satisfied that in the long run, these goals will be achieved. He tends to neglect the small successes he has along the way. In the long term, he doubts his own ability to realize fully his own goals. On his own, he is quite critical of himself.

In Dick's collaboration with Donna, he meets with her to discuss plans for the unit and they keep track of each other's progress. As they reflect together on experiences with the unit in their respective classes, they exchange evaluative comments on what each teacher has achieved so far. Through this process of reflection with his colleague, Dick comes to reframe his role in what has been transpiring in his class during that unit. Despite his initial worry about his pupils' lack of information, he reluctantly acknowledges to Donna:

> I mean if you fit what has actually happened into my very simplistic model of education, then the knowledge and understanding they're getting is how to collect and organize information and how to work within a group and how to prepare and the ability to cope with the world, and once you've got this information, how to present it. And these are all very important.

His partnership with Donna has enabled him to recognize the small gains he has made and this enhances his own self-esteem and improves his professional outlook.

### 5.3.3. Mastery and Coverage

In spite of a tendency to view practice differently, Dick and Donna have a similar approach to the teaching of science and this contributes to the trusting, sharing nature of their alliance:

> Dick: We're along different tracks...although I mean if we actually had to work in the same room, we'd still be able to manage quite well, I think.
> Donna: I think we like ideas and we have enthusiasm for what we're doing. And we like change—trying different things. On that basis, there's common ground. We like developing units and talking about them.

They work hand in glove to design instruction in science. The unique repertoire of pedagogical and content skills that each has been said previously (Chapter 4) to bring to the design and teaching of science units, enables them, as a team, to design instruction in science which aims not only for mastery but also for coverage. It has been said that teachers are continually faced with the dilemma of aiming either for mastery of content or for coverage (Webster, 1982). Donna has been described as having good skills in the organization and management of the subject matter and pupils. Dick, on the other hand, has specific competence and knowledge in the skills and processes of science. These aspects of their individual abilities have a favourable impact on their collaboration. Not only are they able to provide adequate coverage of the curriculum but also, they encourage their pupils to reach mastery of scientific concepts. By working together and pooling

their strengths throughout their science teaching practice, this couple manages to strengthen the individual performance of each one of the partners.

5.3.4. Reciprocity and Compromise

Their relationship, though complementary, requires compromise. They jointly decide what they are to teach, the content to be covered and techniques for pupil mastery. But each teacher is able to implement that design in keeping with personal appreciations of professional identity and prevailing circumstances in class. What occurs in each science class is consonant with the teacher's own sense of self, the subject and personal pedagogical aims and experiences. However, their joint operation provides a channel for each one to express and justify, if called upon to do so, personal aspects of classroom practice. By jointly anticipating how lessons and units ought to work, by analyzing together how these lessons did work and reflecting on ways of modifying or discarding elements of their practice, each teacher creates an unusual, but valuable, opportunity for sharing views and expertise in teaching with another professional who works in the same setting.

Through joint reflection on practice, their collaboration provides ground for comparing and measuring one against the other:

> My biggest worry at the time was that he [Dick] was doing a better job of getting the content across... I thought, "Oh no, they'll know more about the Circulatory System than my kids will know." And yet, he was feeling the same at one point.

As argued in Chapter 4, had they been working as individual teachers without collaborative contact, there would be little scope for this kind of self-critique or exchange of professional expertise. Working alone offers little chance for a teacher to receive feedback from a colleague with a similar level of expertise, in a non-threatening, constructive manner (Jackson, 1968; Lortie, 1975).

The reciprocal but dynamic tension that holds this partnership together relies on good communication. Their joint reflection on practice allows for communication that enriches and strengthens their collaboration. Through reflection, each teacher can divulge and work out differences in their appreciations of professional identity and they can then negotiate compromise. Thus, joint reflection on practice is able to enhance professional growth for each teacher. In practice, collaboration affords Dick and Donna rare moments for such reflection; moments which would otherwise not exist for them working independently of each other.

### 5.3.5. Curricular Autonomy

The colleagial contract that Dick and Donna share requires from them flexibility and compromise but it also allows them as a team to have a certain degree of autonomy in curriculum decision making in science. By pooling their resources, they can escape being "slaves to the text". Working together in science, they can pursue their own interests and their pupils' interests.

A field trip or a similar activity is often the focal point around which the teachers' ideas coalesce into a unit. Dick and Donna call these starting points "grabbers", because these activities have the potential to catch, orient and direct the attention of their pupils on a chosen unit. In Dick's opinion, he and his colleague want an "exciting field study to spark the interest [of pupils] or sustain it or to close it off and a balance [of these "grabbers"] throughout the year." It is almost as though their pupils, trapped at first in the net of an exciting "grabber", later have little choice but to channel their enthusiasm into the other teacher-designed activities for science throughout the year.

In essence, Dick and Donna operate as design professionals. Schon (1987) describes designing "as a kind of making" and he remarks that this kind of making is not only complex but also

involves synthesis:

> In contrast to analysts or critics, designers put things together and bring new things into being, dealing in the process with many variables and constraints, some initially known and some discovered through designing. Almost always, designers' moves have consequences other than those intended for them. Designers juggle variables, reconcile conflicting values, and maneuver around constraints--a process in which, although some design products may be superior to others, there are no unique right answers (p. 42).

Just as designers give shape to their products, so too, Dick and Donna, through their collaboration, give shape to the science instruction they design, weaving common curricular ingredients with personal commitments, interests and circumstances. For them, science instruction operates as a process of collaborative design:

> Donna: My problem with what has happened so far is that all the "A" students can do that better than I can, explain those systems and have a better knowledge of them than I have... My concern is that they're doing all the work. If anything, I'm worried about the others.
> Dick: And I want to get everybody up to there and so my frustration comes about because the top five, six or seven are up there. I get back to the same organizational thing as you in the long run.
> Donna: There is a definite concern there and we both have it ... But even the actual involving of a pupil in something, if we find better ways to increaase commitment and involvement or better yet, if the group does, if we give them the skills to do that, then I feel we've done something. I agree, I have anxieties too. You are a very self-critical man. I feel I have to tell you all the time what's going well. I did it today.
> Dick: The funny thing is that, that might suggest that I was paranoid or something, but I have a strong image of myself. I feel that I could be a lot better teacher but I have no doubt I am a good teacher.

As collaborating science teachers, they draw less scrutiny about their work from the school administration than they would as individual teachers. They function as a team in science, sharing the workload, recognizing their strengths and compensating for any professional weaknesses. The principal recognizes their teamwork, sees the enthusiasm of their classes for science and feels secure that the job is well done. Above all, science is being taught and the teaching of it is well-managed and orchestrated.

Dick and Donna's collaborative efforts are aptly described as synergistic. In their partnership, one teacher reciprocates the contribution of the other and both of them benefit. According to Donna:

> I don't know it all and I feel stronger in other areas [than science]. And part of the reason that I encouraged this relationship with Dick was that I perceived science was a real weakness. I have an enjoyment of it. I like it. I like what the kids do with it but I found somebody who could help me run a better program because I acknowledge he knows more about it, how to teach it... how to plan it... But, when he says we'll do it a certain way, right away I am thinking, "How many? Where? With what?..." You see, because I've taught Kindergarten, I have to be organized. It's my whole orientation.

Each practitioner benefits from the collaboration in which they participate. As mentioned in Chapter 4, Donna is able to share in Dick's "big ideas" for science. But she also feels that when he "goes off in too many directions", she is able to keep him on track and lessen his frustration by reminding him

of the realistic goals which they have negotiated. Dick's comments capture the reciprocity of their collaboration:

> In the long run, it's funny. You know you [Donna] were worried about your kids getting behind. I was worried about managing my kids. So, I was worried about the thing you are good at and you were worried about the thing that's my strength.

What emerges from their union is more than the sum of their individual efforts, coloured somewhat by the subtle compromises through which their partnership flows.

## 5.4. Collaboration as Cooperation: JACK AND JESSICA

### 5.4.1. Cooperative Program Design

In the case of Jack and Jessica, each makes an equivalent, not reciprocal, contribution to the collaborative relationship they share. Both teachers have equal control of the entire intermediate program in science at their school. By working together, they maintain control of, not just a year's planning at a particular grade level, but of the four years of the intermediate science program. Jointly they determine what students learn in science from year four to year seven. They agree that:

> There are schools in which it seems that the happiness of the child might come first. In our case, I think we'd

> say that if the child knows something and can do it well, he/she will be happy and instead of saying, "How do we make the children happy", we think, "How can we get them to know this and this and this and then they'll be happy!"

Programming over such a long period affords them flexibility in use of time for coverage of curriculum topics. The program is not broken up into four parts; it is considered a whole, with each year building on the last. Through their cooperation, these teachers manage to design and implement a science program that aims for excellence in outcome and diversity in scope.

Thus, they prepare students in the first year for the rigours of their expectations of the subsequent years:

> We just keep raising the standards so that what we identified this year, what we measured and said was good this year, isn't quite as good next year. We have to do better.

They readily admit that because of this approach, less time is spent disciplining kids and more time is available for teaching the content or skills of science in those years. Programming over such a long time period allows these teachers to maintain traditions within their program, which strengthen how they are viewed by their colleagues and how the program is seen and received by their students. They have a reputation of running a strong, interesting science program. According to Jessica:

> A friend of another teacher told me this. Her friend had a daughter who's taking science at U.B.C. now. She took science in Grade 7 at this school and she was so turned on in Grade 7 science that she's taking science now at U.B.C. After that grade seven year they couldn't turn her off. No matter what the high school did, she was still interested [in science]! And if the parents give credit for that years later, then they carry with them [the feeling that] this was a strong program and they are telling people. And it does come back [to us here].

### 5.4.2. Leading and Following

Both Jack and Jessica have been teaching science for more than five years and each has a considerable background in the disciplines of science. Perhaps because of this background and their expressed love of the subject, they dedicate themselves to communicating that same love of the subject to their pupils. They readily admit that despite the "smorgasbord" of exciting offerings in their program, they would willingly extend it to include other topics and activities. They are always "wanting to do more science".

Their working relationship is smooth. Negotiating compromises is not obvious. Directions emerge and are then pursued by them both. It might be expected that because Jessica initiated the program at the school, she would take a leadership role. But this is not apparent. They have a similar approach to the teaching of the subject and have worked with each other long enough to recognize each other's lead and follow each other's cues for

change, in the course of doing a unit or discussing lessons. Yet, they also maintain a level of individuality necessary to keep the program interesting and variable for their pupils. Jessica's comments are:

> If we did everything similarly, they [pupils] wouldn't have any variation for four years. Hopefully, they get his best and they get my best... We aim for an amicable relationship where we can survive and like each other during the year.

Continuing contact with each other between lessons helps them work hand-in-hand. Jack says:

> When I think I'm getting behind, I do something to get ahead. If she gets too far ahead of me, she'll slow down... I whip things along.

It is true that demands and expectations of pupils are played out differently in their classrooms, because of what they call a difference in "style". However, essential features of the program which they jointly design, remain the same.

5.4.3. Mastery and Coverage

Both teachers want to provide a variety of topics and activities related to science. By providing for diversity in scope and excellence in achievement, Jack and Jessica pursue not only coverage of science topics but also mastery of sophisticated

science concepts. At the same time, they try to capitalize on the enthusiasm and imagination of their pupils. Standards required of pupils are therefore high and rigorous, consistently demanding that they participate actively at their own levels of excellence:

> The thing is that I try to keep a balance of knowledge. They have to know some things because you are not an educated person if you don't know anything. I don't agree with testing and kids' memorizing in order to write tests. But, they have to know something. On the other hand, they don't really remember much, anyway. If they learn anything from us, they'll never know where they got it. They'll just know that they know it, whereas we want to get an attitude of loving science and being interested in inquiry, interested in different approaches to the science subjects. I think it's my job to turn kids on to science. I think there should be some knowledge learned that a person owns, but to me, the major thing is turning kids on to science so that they finally like it.

Much of the science Jack and Jessica teach does not come directly from a text. Current events and controversial issues are dealt with through science content. Students therefore have to invest themselves, their values and opinions in their learning of science. Resources in the library, the media, the environment are all drawn in. And there is an almost uncontrollable excitement among pupils. To present, question and evaluate each other's ideas on a system of the human body is exciting for students. Teachers subtly suggest questions for discussion and investigation, praise their students' efforts while encouraging creativity, facilitating, arbitrating where necessary but in the long run exacting the very best from them all. When pupils give their

speeches, teachers take notes. At the end of that unit, tests are given, based on the teachers' notes. But the results of such tests cannot really reflect the richness of pupils' experiences during the unit or their understandings of sophisticated concepts covered through their presentations. (A sample of one test is appended for reference).

Students are tested only on basic factual information from the speeches given. Jessica expects that:

> Students should know something and know it well.... They should leave the school and be really competent at writing, reading, speaking, [and] at the skills in science that they're going to need when they get to high school.

However, the full extent of students' scientific knowledge and understanding cannot be accurately reflected in tests. The processes which these teachers work to develop in their students cannot be easily evaluated in a short paper and pencil test. What students actually do and how they think in class is of greatest worth to them and to their teachers. Paper and pencil tests can easily cover the basics in the science curriculum; far more is required of these pupils. This is illustrated by Jessica when she relates how she has dealt with one pupil's anxious query about the mark he got for a speech:

> I told him that I gave him 9 1/2 out of 10 because he questioned the audience. His technique of using a question to the audience was quite diffferent. He also put a lot of humour into his talk, well-thought out humour, not just nervous humour. But I lost track of his organization and so I took off 1/2 mark. These kids are polished enough that they should be getting a ten out of ten, but they may not even get a nine if I can't follow the organization of their thinking.

Clearly, Jessica thinks highly of her pupils' abilities and she urges them to strive for excellence. The qualities that she and Jack foster in their students through science cannot be easily tested. Their program demands more than having mere knowledge and skills of science. These teachers value clear thinking, well-formulated and supported opinion, confidence as well as humour and organization in oral presentations. Jack and Jessica encourage their pupils "to gain status, show confidence, build morale, especially for those who do not do so well on tests". They both agree that what they want from pupils is:

> Liking science and using scientific techniques to face problems and solve problems so that they [pupils] look at science not as something separate from their lives--and just a course in school!

5.4.4. Compatibility and Style

A most dominant characteristic of Jack and Jessica's relationship is their compatibility. Granted, each displays a different personal "style". In class Jack is brisk and business-like, using humour to encourage pupils to conform to his demands. According to

Jack, he "goes into more detail" while Jessica "goes in and out of topics faster". Jessica has a quiet, nurturing manner in class and she is tolerant of difference in her pupils. Yet, both teachers are consistent in their demands of students and their approach to teaching science, preferring to aim for overall excellence in pupils as well as variety and balance in their well-rounded program:

> Jessica: Well, every year my expectations go higher.
>
> Jack: I mean, I push yours up and you push mine up higher.
>
> Jessica: As we've gone on, we keep raising standards...

They are able to recognize each other's strengths and needs and accommodate to these comfortably and amicably, without protracted negotiation:

> When I came here, I only knew one grade and I'd never taught them all. So at first, I borrowed a lot of her [Jessica's] script. I went along with it and if I liked it, I added to it. Basically I liked it. There was lots of variety and so I was able to add something. I'd say, for example, "You've never done blood typing?". And she'd say, "Oh, what would you do? Let's try it." And we decided that it might work and we did it. We were teaching grade six together once and we put it into their program then. Now, when we teach grade six [science], we just do it without even thinking.

They have extensive knowledge of each other's practice. The students they teach have had either of them for science in each of the four years of intermediate science. It is likely that from

year to year Jack and Jessica have been able to grow more familiar with each other's personal classroom practice through their dealings with various groups of pupils in the intermediate grades. They have come to "know" each other therefore, not only through their direct interaction with each other in the course of co-creating science instruction, but also through the pedagogical experiences they have shared with the same groups of pupils over time.

As specialists in the teaching of science, they are to their peers at the school, the "science experts". Students too view them as a team. Both of these perceptions acknowledge the cooperative nature of their alliance. However, this cooperation seems to result from their own flexibility and tolerance of each other's differing appreciations of classroom practice and also from a mature knowledge and recognition of each other's style and competence in the teaching of science.

### 5.4.5. Curricular Autonomy

As in the previous case of teacher collaboration, because of their partnership and joint management of the science program, the administration seems to "leave them alone". They are able to "free themselves from the curriculum" but, with their combined expertise and knowledge of the curriculum, they can readily draw connections between what is mandated and what they do in the program:

> But you see, because we do all the science, we don't have to stay with STEM or Laidlaw. We can say, "How can we build a good program?", and we come to grade seven and we say, "These kids should know a fair amount of anatomy ...It is a good time to do it—in grade seven—because that's the year when they're very interested in their own bodies.

Thus they are able to justify the more "eclectic" aspects of their program. It is important to them to be able to justify what they do, recognizing that collaboration strengthens their position of controlling the intermediate school science program. As a team, they are autonomous and independent in curriculum decision making and instructional design in science.

The program is therefore a rich amalgam of topics and activities geared to encourage students to master sophisticated scientific concepts which are relevant to their daily lives:

> Jessica: They will each know one system well. They will have touched on other systems. So they will have a general discussion of the body and some of it at a rather high level...
> Jack: See, the thing is, we have to distinguish between [a student] who can memorize and one who can take someone else's information and think about facts which no one has really clarified [for the student], and organize them. There is even a difference between that and giving them [students] an experiment and asking them to figure out what's going on.

Jack and Jessica aim to produce well-rounded pupils, with a breadth of exposure to the disciplines of science. Their program includes rigorous discussion and critique of popular social issues

related to science, such as environmental control and protection of endangered species. During the four years in the program pupils learn such things as:

(a) taking notes accurately,

(b) formulating and presenting informed opinions, and arguments with clarity in a speech,

(c) orienteering and using the environment outdoors for scientific investigation,

(d) raising questions and seeking answers through critical thinking, "hands on" enquiry or the use of models,

(e) analyzing their own experimental methods and evaluating their answers.

Furthermore, very little of this comes from a text; much of the content flows out of the personal interests and resources of teachers and students. Information from various sources is blended into the program. As Jessica remarks:

> Our librarian has books and information on the systems [of the human body] and because this topic lends itself to [using] various sources, we can't use a textbook. They [pupils] have got to be able to go to more... We don't need to use the text; we've got enough. It's so limited.

In this way, these teachers generate and maintain a challenging program for students and they too are able to preserve, not only

curricular autonomy but also a high level of professional excitement about science in their teaching of the subject.

Both pairs of teachers appear to find their collaboration in science workable and productive. But the basis of collaboration in each pair seems different. Dick and Donna do not have similar appreciations of their identity as teachers of science but, through their partnership, each teacher can rethink and re-examine personal appreciations of practice, eventually negotiating a compromise. With Jack and Jessica, teacher collaboration is equally effective. However, despite different "styles", their comparable knowledge base and a shared approach to the teaching of the subject reduces the need for negotiation. Their partnership is more equivalent than reciprocal and Jessica expresses this quite well when she says:

> Jack and I teach [with] different styles. We made up different tests because our pupils covered different information. The results of the tests, and we made them both out of 50, the results of the tests showed that we were within one point. Our top pupils were within one point. Mine was 47/50. His was 46/50. The bottom youngsters were within a couple of points. We both had the same number of failures, within a person or so. It's not amazing to me that in that science test we were so close. We do this all the time in all the units... which makes me think [that] as teachers, we know what we're doing.

## 5.5. Chapter Summary

The discussion in this chapter has focussed on the nature of the collaborative relationships between the teachers in the study. In spite of appreciative differences, these four teachers voluntarily formed productive partnerships. Whether based on a synergistic relation as with Dick and Donna, or on a cooperative alliance as in the case of Jack and Jessica, these collaborative partnerships in science were purposive and beneficial.

Collaborative science teaching prompts teachers to determine jointly the direction and emphasis for their science instruction. Collaboration also provides teachers the opportunity to develop more extensive and enriched treatment of science topics, making it possible for them to achieve better mastery and coverage of the content of science. When they work as a team, teachers become more autonomous in determining the content and appropriate techniques for their science instruction.

The appreciations of these teachers suggest what their major concerns about teaching elementary science might be. Furthermore, teacher collaboration would seem to be a significant preference for handling these concerns. In the following chapter, teachers' concerns are reviewed to indicate the significance of collaboration as a means of enabling these teachers to handle their concerns.

# CHAPTER 6

# TEACHERS' CONCERNS ABOUT THEIR SCIENCE TEACHING AND THE SIGNIFICANCE OF COLLABORATION IN TEACHERS' HANDLING OF THEIR CONCERNS

## 6.0. Introduction

In an attempt to gain better understanding of the nature of teaching practice, this study set about to examine how teachers construe their worlds of practice. The preceding chapters contain descriptions and comparisons of teachers' appreciations of themselves and their science teaching, with a focus on the nature of the collaborative relationships shared by teachers in this study. In this chapter, the collection of teachers' appreciations and the forms of teacher collaboration are again looked at, in order to identify general concerns about science teaching practice which this group of practitioners routinely address. The word, "concern", is being used here to indicate a domain of practice on which these teachers consistently focussed, one that was the subject of considerable teacher attention and initiative throughout the study. By considering such concerns, this chapter is intended to respond to the third research question which asks: "In view of the nature and comparability of these teacher appreciative systems, what major concerns about their science

teaching do teachers have and what is the significance of teacher collaboration in teachers' handling of these concerns?

Various claims have been made in the literature about the isolation of classroom teachers and the lack of opportunity teachers have for colleagial support (Jackson, 1968; Dreeben, 1970; Carew & Lightfoot, 1979). Despite these allegations, it is still not clear how pervasive a phenomenon teacher collaboration is or indeed, whether teachers favour isolationism over collaboration (Feiman-Nemser & Floden, 1986). However, this inquiry was not designed to address issues of isolation versus collaboration in teaching. But, teacher collaboration was found to be a key feature in the science teaching practice of the four teachers studied here and in this case, collaborative teaching has to be considered an outstanding feature of these teachers' worlds of practice.

These teachers voluntarily chose to establish and maintain collaborative relationships with peers, throughout their teaching of science. Their partnerships involved them in joint reflection on various aspects of their practice. In the course of their reflection, individual teachers articulated and justified their own appreciations of their roles as teachers of science and expressed their ideas about how science should be taught in their classrooms. Teachers' expressions of their practical and professional concerns about science teaching and their views of

Table 6.1 Summary of the Appreciations and Concerns of Dick, Donna, Jack and Jessica

1. Providing Instruction to a Pupil Clientele

reflecting teacher interests and commitment

pursuing pupil interests

catering to student needs

being satisfied at pupils' achievement

generating excitement and enthusiasm of pupils for science

2. Designing Units of Instruction

establishing and maintaining curricular autonomy

- working as a team
- not relying on the textbook
- including teacher and pupil interest

assessing personal resources for teaching science

- generalist or specialist
- complimenting each other's "scientific" knowledge

the actual process of "making" a science unit

- setting the target
- hunting for ideas
- trial and error
- fine-tuning and follow-up

3. Obtaining Professional Self-Renewal

constantly searching for ways of improving practice

exchanging expertise and knowledge in collaboration with a colleague

handling these concerns were therefore a natural part of their collaborative relationships. What follows is a discussion of the major practical and professional concerns of these teachers. It is suggested that teacher collaboration can be viewed as a strategy used by these teachers for accommodating and efficiently handling their concerns.

## 6.1. Teachers' Concerns about their Science Teaching

Tables 4.1. to 4.4. as well as Table 5.1. illustrate the clusters of appreciations of teaching practice which these teachers held individually and collaboratively. Table 6.1. summarizes teachers' key appreciations to show how these pertain to three major areas of concern. It is evident from Table 6.1. that these three areas of concern are as follows:

(1) how to provide a level of instructional services which they find suitable for their pupil clientele,

(2) how to design units of instruction, appropriate for their pupils and compatible with their own views of practice,

(3) how to obtain ongoing professional development or self-renewal "on the job".

Each concern is outlined below, along with an examination of how

these teachers deal with their concerns through collaboration.

### 6.1.1. Concern 1: Providing Instruction to a Pupil Clientele

As practitioners, Dick, Donna, Jack and Jessica seek to provide their clients, the pupils, with the level of instructional services they think, not only appropriate to their students' needs but also compatible with their own appreciations of science teaching. This desire to supply the right level of instruction for a particular group of individuals has been of major concern to them all. Jessica expresses her concern in this manner:

> Anyway you read in the newspapers, especially from the U.S.A, where there are complaints that people look at science as a category outside of real life and they don't look at things as a part of science and it is said how terrible that is. I often think when I see that, "Oh, good! That is not happening in my classroom." [And also]... I want kids to like science. My goal is to turn children on to science, [for them] to be excited by it and [for them to] think it's a part of their everyday life and that everything that shows up in the news and the paper is a part of science. Interest, that's the main thing. All the extras, the knowledge and skills come second to liking it and wanting to do it well and having it as part of their thinking.

Similarly, Donna expresses her satisfaction at what her pupils have achieved in this unit. In her own words, she remarks on,

> ... the excitement of the kids, the fact that I can say, "Bring some material in." The interest after school, the begging me to go to the science room. It's

> the enthusiasm of the kids. These oral reports, how they feel about science, that it is integrated into kids' lives in the classroom.... there is an enthusiasm for science. I feel good about it when I see that there is that enthusiasm for science! ... I think it's encouragement. I feel we give kids the encouragement to do science and to observe it and bring it in. It's all around us here and they are encouraged...

Generating excitement and enthusiasm for science as a discipline is for both of these teachers an important feature of their science teaching practice about which they are concerned. They desire not only to have students do the curricular activities of science and familiarize themselves with the content of the subject, but also to have students invest themselves in the joy of learning science. This adds another dimension to their jobs as teachers of science. These teachers do not see themselves as mere providers of scientific information; they are also dedicated to transmitting their personal appreciations of science, say, as a worthwhile, exciting endeavour, through their teaching of science. The instruction which they provide to their students is a reflection of such appreciations and the nature of their commitment to science teaching.

In catering to their pupils, each teacher brings into play a personal "style" of teaching (previously mentioned in pp. 99 - 103; 120 - 122). These teachers' instruction to students is thus mediated by their individual appreciations and expectations of pupils. The one, Donna, operates her classroom as a collective and often uses grouping to enable and encourage her pupils to work

cooperatively with each other so that the class as a whole can experience a high level of success with instructional tasks. "My concern", she says, "is that they are all doing the work." The other, Dick, admits his overriding concern for the flowering of the individual student and he operates accordingly. But by working together in science, both come to recognize their differences and together they have the opportunity, within a colleagial setting, to consider change.

Collaboration imposes on both teacher participants the requirement that, in planning and working together on instruction in science for their classes, that they share personal preferences. For instance, when Dick and Donna work with each other in science, their partnership encourages them to come to terms with their own personal pedagogical preferences and views of their students, which are openly discussed among themselves. This process of divulging personal elements of teaching style is part of joint reflection on practice which occurs naturally when teachers decide to teach in collaboration:

> Dick:... So, for example, it never occurred to me to clean up in the way that Donna does... In my room I say, "Before recess, we're going to clean up this room." So on the board I write up," #1: Clean top of the desk. #2: Put all possessions in a bag. #3: Put anything that's not school on the floor. Then when you've finished that, work." I listed a whole lot of things to be done. So, what happened; it did actually work. They all cleaned up their desks and that went fine until about 10 o'clock, they all clustered around me saying that they had nothing to do!
> Donna: Weren't they doing their work? It said on the

board, "Do your work."
Dick: I know but by this time of the day. Anyway it was the last day.
Donna: But Dick, this year you did, you said at the end of last year, there were some things you weren't satisfied with... And I saw you very systematically this year, become in quotation marks, more organized in some areas.
Dick: Yes. yes.
Donna: And you've had a much smoother year... But the important point is that you have made some significant changes...
Dick: It got better this year and I had more 15 minute recesses this year.

Despite differences in perception, both teachers agree that Dick can benefit by honouring his commitment to himself to work on his organizational skills.

The capacity of professionals to reflect on their practice, as exemplified above, is said to characterize the essence of their professional expertise (Schon, 1983; Benner, 1984; Schon, 1987). If the ability of teachers to reflect on their practice is connected to teachers' potential for self-improvement, then the joint reflection on practice which is part of collaboration is also likely to enhance the kind of service teachers provide their pupil clientele.

Many recent studies attest to the importance of determining the nature and quality of teachers' reflective thinking in practice (Marin, 1986; Erickson, 1987; Grimmett, 1987; Haley-Oliphant, 1987; MacKinnon, 1987; Riecken, 1987). Although these studies do not identify the precise role of reflection in

teaching practice, they suggest that reflection is beneficial to practice. It is clear, from studies of the practice of Dick, Donna, Jack and Jessica, that collaboration promotes reflection on the personal bases of their practice. Through collaboration these teachers, especially Dick, tend to become less self-centred in personal preferences for practice and more amenable to appreciating the merits of other "styles" and pedagogical approaches to handling practical concerns. In this sense, collaboration has enabled the teachers in this study to improve on the level of professional services which they wish to provide to students.

### 6.1.2. Concern 2: Designing Units of Science Instruction

As a major concern, unit design includes a set of related sub-concerns, which also require consideration. These are:

(1) establishing and maintaining curricular autonomy,

(2) assessing personal (specialist versus generalist) resources for teaching the subject matter of science, and

(3) the actual process of "making " a science unit.

Each of these three sub-concerns will be reviewed separately below.

6.1.2.1. Establishing and Maintaining Curricular Autonomy

By working together in science, collaborating teachers in this study can maintain a considerable degree of autonomy in curricular decision making in that subject. For example, Dick and Donna jointly decide the times in the year when science is to be scheduled, topics to be covered at these times, techniques for conveying the subject matter to their pupils and for checking how well pupils are receiving this information. In Donna's words:

> I think because Dick and I decided to free ourselves from the curriculum in science and socials, we more or less do what we want and by that I mean, the kids' interests and our interests. It is really personally-based science and we get excited about it. We don't feel that any one is telling us what to do in science. It is up to us.

As indicated previously in Chapter 5, the four teachers in this study feel that they are subject to less scrutiny from the administration of the school (p. 150).

While collaborating, they can decide to forfeit reliance on a prescribed text as a primary source of ideas and look to the sharing of their own expertise, ideas, personal and pedagogical experiences as resources for teaching science. As Jessica says:

> I think of wanting to use the swamp, so we make up units to get us out of the classroom to the swamp. Mount St. Helens went off and the newspapers were full of information and the school board gave us some

> information and the kids were interested and we were interested. That became a unit.

Thus, they are able to pursue their pupils' interests and their own interests in the subject as well. Instances of these aspects of their collaboration have been presented in detail earlier on in this dissertation (pp. 91, 105, 110, 150). The following excerpt, in which Dick and Donna jointly reflect on a unit and how it started, illustrates how easily these two colleagues are able to reiterate together their intents to monitor and control all aspects of a unit of science instruction:

> Dick: Well, we sat down. First of all, we decided we'd do something on the Body. And then we decided how we'd do it. We first of all telephoned the Arts, Science and Technology Centre and asked what shows they had on. They said [that] they had "Bodyworks". We'd already decided to do something on the human systems by this time...
> Donna: We looked at the date. We knew our starting date and our closing off date. We were starting on a Monday and we knew we were going [there] on a Wednesday. So they had to have some exposure, we felt, to the skeleton and the muscular system and so the modelling and the getting ready for the field trip happened on those two days, Monday and Tuesday.
> Dick: Right, the intention was in fact that... each group was to produce, to do a good copy of this sheet and then ... give a five minute presentation. On Thursday morning, we were going to review the field trip...

Jack and Jessica are just as autonomous in making their decisions about their science teaching. However, as mentioned previously, because they share the teaching of all the science at their school, from grades four to seven, their autonomy extends

beyond just one year's classes to the entire intermediate science program at the school (p. 114). Jessica explains how certain aspects of their program have come about:

> I went to the high schools and asked them what they wanted from the children here and they said [things like] graphing. So, I built programs [in science] based around [pupils] having to be knowledgeable in certain areas when they left and [giving them] a body of knowledge that fits into those areas.

As colleagues, these teachers consider that they have an exclusive responsibility to determine what the content of science instruction is to be and which topics are most important for their pupils. Jack himself affirms that:

> ... it's a matter of which one we want to do. That's what it really boils down to. There's the eye. There's the ear. There are food chains. There's photosynthesis. There's anatomy. There's the microscope. There's chemistry. All we have to do is sit down with a piece of paper and write down all the different areas of science and first say, "When are we going to do this and this?"... Every second year we do a chemistry unit and we do it with all the grade sixes and sevens at the same time because they can handle it.... Well, Chemistry should be taught somewhere, as far as I'm concerned but mainly at the higher level because the kids are then interested in it.

By pooling their resources in collaborative teaching of science, Dick and Donna, Jack and Jessica are able to run their science programs according to their own agenda for science. The nature of collaboration is such that, in considering what content to deliver to pupils and in selecting appropriate strategies for teaching,

they can decide not to rely totally on a textbook. Instead, they look to the sharing of their own ideas, experiences and expertise as resources for teaching science and these are coloured by their appreciations of the subject itself. By forging together and moulding a joint practice of science teaching, they draw the attention of the school administration to their joint, not individual, efforts and the former efforts receive tacit approval while the latter draw less scrutiny than is usual. Their units of science remain stamped with their unique imprint and they are able to provide pupils with enriched content and innovative, challenging and interesting activities.

6.1.2.2. Assessing Personal Resources for Science Teaching

Each of the teachers in this study has personal views of his/her ability to teach science and these appreciations seem to be related to these teachers' perceptions of their personal store of scientific knowledge. For instance, Donna considers herself to be a "generalist", one with little of the specialized knowledge of science and this appreciation influences how she approaches the teaching of science (p. 97). Seeing herself as one who is not "scientific" and just "two pages ahead" of her pupils colours how she teaches science and how much time is given to science in her class.

She attempts to compensate for her perceived lack of personal

resources in the subject matter of science in two ways, individually and collaboratively. Firstly, she herself studies the content when she has to teach a particular topic and aside from her regularly scheduled science classes, she also teaches "incidental science". Thus, her pupils have more than the normal exposure to science as a classroom activity. Also, in her approach to teaching science she is not hesitant to ask pupils to research an answer to a question that she does not know. Often she works along with them as a partner and guide and, her pupils are very interested and excited about science. Secondly and more importantly, she has developed a collaborative working relationship with Dick whom she perceives to be more "expert" in science than she is.

Being a generalist teacher who has to teach all of the subjects also places severe demands on her time and expertise. Her collaboration with Dick can be seen as her attempt to compensate for her own lack of personal "scientific" resources. She acknowledges that as a generalist she has a drawback. She does not feel equally competent in all the subjects that she teaches (pp. 98, 99). For subjects such as social studies and science, which are considered to involve specialized content and skills, it is difficult for teachers like Donna to have enough time and energy to provide themselves with the background and skills necessary for personal competence in the teaching of specialized subject matter.

It has been suggested that because of their perceived lack of specific knowledge of science, teachers feel untrained and uncomfortable and so they are reluctant to teach elementary science (Stake & Easely, 1978). This is not the case with Donna; her collaboration with Dick accounts for the difference. She admits (on p. 150), "I found somebody who could help me run a better program because I acknowledge he knows more about it [science], how to teach it, ... how to plan it..." Through the reciprocity of collaboration, she is able to supplement her perceived deficits in content knowledge. Also, as mentioned previously, she has in her colleague a concrete referent against which to measure her own science teaching practice (p. 147).

6.1.2.3. The Actual Process of "Making" a Unit of Science

Considering the collaborative efforts of Dick and Donna and Jack and Jessica mentioned in Chapter 5, these teachers can be said to operate as "design professionals". Essentially, they "make" and test their own science curriculum in the course of their collaboration. This kind of making is viewed by Schon (1987) as designing. Science teaching, for the four teachers in this study, operated as a type of collaborative unit design.

It is commonly acknowledged that teachers are the ones

directly responsible for translating curriculum into the particular frame of instruction appropriate to their settings and their pupils (Shavelson, 1976; Bussis, Chittenden & Amarel, 1976; Dillard, 1986; Lampert, 1987). Teachers design their own instruction. But, design is a process of conceptualization and conceptualizing instruction requires time and expertise. For the teachers who were studied, the practical embodiment of their strategy for conceptualizing science instruction is evident in their collaborative design process. Their design of instruction seems to occur in cycles or waves of activity, namely, setting the target for instruction, hunting for ideas, trial and error and fine tuning and follow-up. These are discussed in more detail below.

Setting the Target. Conceptualization of science instruction appears to begin when teachers decide to do their yearly plans and perhaps submit these to the principal. They outline a course of action, delimit topics to be covered in particular blocks of time. At this point of the design process, there is a tendency for teachers to draw selected topics from disciplines of science such as biology, chemistry and physics. According to Jack:

> We say that they have to have a little bit of a dab of biology. Have they had a dab of chemistry? Do they know what physics is? Do they know what chemistry is? Do they know what volcanology is? Do they have a well balanced scientific diet before they leave?

Hunting for Ideas. The time for the first unit draws close and about two weeks before, teachers get down to work. A frantic search for ideas begins. The prescribed text was not the chosen source of ideas for these teachers though Jack admits that ideas are collected from various sources. Ideas may come from other teachers, materials, texts, the media and from his colleague. In his opinion:

> Teachers are great stealers of ideas. I don't think there are many of us who say, "That's really my idea." All my ideas come from somewhere else, either through the university or other teachers or a textbook, whatever... I present them [in] the way I am comfortable and I guess that makes the difference.[Again]... Because I work on a school board committee for science, I get ideas from there... I meet with them maybe once a month or so... I mean I get ideas from them that I won't normally have... Isn't teaching borrowing everybody else's ideas anyway!

For Jessica, personal interests add to her sources of ideas for designing units of science instruction. She says:

> I feel I'm learning all the time. And if I get interested in an area, it ends up in the unit because if I'm going to do the reading and the work, for my own interest, [I have to] learn something. Usually I'm excited enough to share it and that's how alot of these units get started. [And also].... For science I think [about] what we can do that's "hands-on", what are we interested in. Then we make up the unit and we go after the equipment...

As Dick says earlier on (p. 89), teachers place high value on the collaborative search for ideas since it provides an avenue through which they can "have their ideas used ... and more [of their]

ideas actually get into practice."

Trial and Error. From their ideas teachers negotiate a frame for a unit of instruction. It is the unit, not the lesson, that is the initial focus of teacher attention. Lessons contribute to achievement on a daily basis, of priorities which teachers have already set for the unit. Having determined directions, starting points are found; past experiences, expertise and resources are shared. Ideas from old units are revitalized, embellished or rejected. Together, teachers envisage how much they can cover, what they want to get out of that unit, how interesting it can be made for all concerned. Among the four teachers there is a definite preference for creating new units. There is also a feeling that units are best perfected through trial and error. According to Donna:

> I think it is our way. I feel very uncomfortable about repeating anything in socials and science. If I did the same thing next year, I'd be bored... So we normally don't repeat a unit. Of course it [the same unit] wouldn't go the same every time because you're learning and you're making mistakes and you're actually right on the spot developing it, to improve it, and then, there is the group of kids you're teaching.

Jack also explains his view of a "trial and error" approach to unit design. In Chapter 4, he asserts that he cannot ever guarantee how a lesson "is going to go", even though he usually has firm expectations of what ought to happen (p. 118).

Fine-tuning and Follow-up. Ideas for a unit are actually reframed in class as they are played out. The teachers then meet to compare what happened in their respective classes. A lesson is replayed for a colleague and together, the teachers re-sift and sort ideas about pupils' abilities, their own skill and the content of the lesson itself, rerouting its path to meet their personal investment and professional commitments. Reflecting on this part of the process, Jessica relates:

> We've worked out some very good lessons and we've talked about them and we've thrown away the parts that didn't seem workable... either it was too difficult [in content] or in materials or whatever, or the lesson didn't go anywhere, or it was a total disaster.

The critical path in this collaborative design process is the teachers' "hunt for ideas". At this point, "two heads are better than one" is the operative idiom. Together, teachers use old ideas to generate new ones. Ideas about content are sorted for their appropriateness to the task. Ideas about pupils and their ability to handle proposed concepts are exchanged. The discussion in Chapters 4 and 5 indicates that, for these teachers, joint conceptualization of the unit enriches the content knowledge base of each teacher and helps each of them update and consolidate their own content ideas and pedagogical knowledge of the subject (pp. 104; 145-151). Collaborative unit design also serves to enrich the repertoire of instructional skills available to each

teacher for a particular unit of instruction, stimulating exchange and analysis of relevant pedagogical experiences. Teachers' joint choice-making and reflection, prompt them to re-evaluate and improve on their practical skills.

### 6.1.3. Concern 3: Obtaining Professional Self-Renewal

Dick, Donna, Jack and Jessica attach great importance to the work of teaching science but they are constantly in search of ways of improving their own practice. This self-imposed pressure for improvement is personally driven but it appears to be strengthened by the reflective nature of their collaborative relationships. Dick explains what his desire for self-improvement is like:

> ... or saying, "I'm going to do something. Now how can I go about doing it. I have to teach this unit on the body. Now how can I go about teaching it?" If everything went swimmingly and I couldn't think of different ways to do it, or how to change it or whatever, I mean, you know one of my whole reasons for being would have disappeared. So, I have to be critical [of myself]. I have to think of, "What can I do better? What can I think of next? I don't like that, so I'd better change that." Because that's how I operate all the time, I think.

Each teacher in a collaborative partnership helps the other to draw closer to some desired level of professional improvement. Collaboration facilitates an exchange of expertise within the actual context of practice and this is valued by the practitioner. Whether collaborating teachers share similar views of their

identity and similar preferences for practice or whether they have differing appreciations of practice, that is, regardless of whether collaboration is cooperative or synergistic, the collaborative relationship is one of mutual trust. Both pairs of teachers in this study attest to the flexible, trusting and productive character of their professional relations. Donna illustrates how she and Dick prompt improvement in each other's practice:

> I showed Dick six steps I learned for putting kids into groups. I told him, "Now you wouldn't do it exactly like this but maybe this would be useful [to you]." So he is sitting and I'm explaining and he is writing. But he is changing it to what he wants as he is doing it. That doesn't threaten either of us because he is very different from me and we operate differently... this makes us really able to criticize each other. I'd say, "I'd never do this this way but you can do it that way; I'll do it my way. Mine will be more structured and you can allow more of this, more freedom in this area." And I think we learn from each other.

Especially in the case of generalist teachers, such as Donna, without a "good science background", collaboration in science teaching can offer a measure of professional security which ameliorates concerns for personal deficits in content knowledge. Through colleagueship such teachers can improve their own content knowledge base in the subject without the pressure of participating in a formal, evaluative structure. It is important to mention that, in this study, teachers' collaborative efforts at professional self-renewal were voluntary, self-motivated, self-regulated, occurring naturally within the context of their

current practice. This kind of collaboration provided for enhanced professional growth and probably contributed to better design of innovative units of science instruction. Other studies of teaching lend support to this finding (Lanier & Little, 1986; Smith & Neale, 1987).

## 6.2. Overview of the Significance of Collaboration

In Putting it all Together, William Rothschild (1976) examines corporate success and argues that successful corporations have strategy and that moreover, their determination of strategy accounts for their success. Strategy, he affirms, is a "statement of an organization's investment priorities, the management thrust and the ways that it will use its strengths and correct its limitations to pursue the opportunities and avoid the threats facing it." In the business of teaching, teacher collaboration is strategy.

It is through collaboration that teachers devise a flexible game plan for prioritizing personal and instructional goals, jointly working out ways for smoothly managing their practical and professional concerns. The views and experiences which teachers in this study brought to their collaboration have been typified in their appreciations described in foregoing chapters. Yet, even teachers who varied somewhat in their appreciations, were able to

collaborate productively. This might imply that these teachers viewed collaboration as a useful and productive strategy.

Strategy is more than mere planning. Granted, the game plan that teachers negotiate contributes to their strategy. But, as implied by Rothschild (1976) in his discussion of corporations, collaboration as strategy includes a comprehensive investment of personal and professional priorities so that teaching colleagues delimit and manage their sphere of operation effectively, within its context.

The game plan itself is flexibly held by each colleague. It is not an indelible path; it is a recognition of one's own personal and professional limits in teaching a particular aspect of subject matter. This has to be so for in the classroom, certain features of the context materialize. The press of these contextual demands operates to change directions, as though dictated by the pragmatics of the moment. Besides, each partner has a certain style through which the game plan is implemented appropriately in his or her class.

As strategy, collaboration does enhance professional development. Teachers who collaborate take the responsibility of sharing their personal appreciations and experiences with a colleague. They consult with and support each other. Joint prioritizing of goals and sharing of resources act as a buffer

against work overload. They coach each other in content. The feedback that they give to each other in reflecting on their practice is systematic, rigorous and non-threatening but invaluable for personal and professional growth.

Teachers express great commitment to their work and often they let professional work encroach upon the private territory of their lives, seeing the expression of their lives through the demands of their profession and vice versa (Lortie, 1975; Clandinin, 1985). But through the conditions of work and weighty practical demands of their job, their commitment can sometimes wane. Though they cannot normally rely on institutional support to boost their morale, they seek to enjoy their practice and not merely to survive it. Collaboration lessens their isolation, bringing them into regular contact with peers with whom they can easily and regularly share the joys and disappointments of practice, without fear of reprisal.

## 6.3. Chapter Summary

In this chapter teachers' concerns for their practice of science teaching were identified and discussed to indicate the significance of collaboration in enabling the teachers in this study to handle these concerns. Teachers had three main areas of concern, oriented to the design of instructional units, provision of client services to pupils and their own search for professional

improvement and self-renewal in the course of their practice.

In summary, voluntary teacher collaboration seems to:

(1) enable teachers, especially those who see themselves as generalists, to get together and share the work of teaching a specialized subject such as science.

(2) enable teachers, especially those who perceive themselves to be specialists, to be innovative in their instructional design, to enrich both content and coverage of science and also to provide a level of service to their pupil clientele that is coloured by their own appreciations.

(3) provide opportunities for teachers to work with a colleague towards self-improvement and to compensate for perceived personal and professional inadequacies.

(4) provide opportunities for teachers to reflect on and analyze their preferences for practice and so ameliorate the isolation of their jobs and provide ongoing self-renewal.

The final chapter contains an overview of the study and its findings as well as tentative conclusions and implications based on these findings.

# CHAPTER 7

# SUMMARY, CONCLUSIONS AND IMPLICATIONS

## 7.0. Introduction

In this chapter, the original purposes, questions, methods and major findings of the study are briefly reiterated. This overview of the study is intended to summarize what has been accomplished by this investigation of teaching practice. Briefly revisiting the perspectives, questions and findings of the study can provide an appropriate background against which to make certain tentative conclusions and speculate on the implications of these. Finally, recommendations for further study of the theory and practice of elementary science teaching are suggested.

## 7.1. Summary of the Study

This was a naturalistic exploration of the nature of elementary science teaching practice. The main purpose of the study was to portray, through teacher appreciative systems, how four elementary teachers perceived their worlds of practice. This study is based on the assumption that practitioners routinely engage in the making of their own worlds of practice. The construct, "appreciation" was advanced as the embodiment of the intricacies

of teaching practice which involve teaching practitioners in negotiating between the personal, professional domains of practice and the more pragmatic, contextual demands of teaching. Teacher appreciation has been used as a heuristic for objectifying the process of investigating teachers' worlds of practice, according to the basic assumption of the study.

The specific purpose of this inquiry was to investigate and compare four teacher appreciative systems of practice and then to use this information as a basis for exploring the nature and significance of their collaborative teaching of science. Three research questions stemmed from this purpose and these pertained to the nature of teachers' appreciations, the extent to which teachers' appreciations were comparable and the concerns about practice which teachers' collaboration seemed to indicate that they shared. Findings that provide responses to these questions are summarized below.

## 7.2. Conclusions

In response to the research questions of this small-scale exploratory study, a number of tentative conclusions can be drawn. These, however, must be considered in the light of the limitations of this study mentioned in Chapter 1. Granted, this was a study of four specific cases of science teaching and therefore the generalizability of conclusions that may be drawn from this one

inquiry is somewhat limited. On the other hand, conclusions of this study may well serve as hypotheses to be tested in further studies. The knowledge of science teaching available in this study is also likely to be of interest to practitioners and teacher educators. Insights gained from knowledge of this kind has the potential to enhance understanding of teaching practice.

### 7.2.1. Teachers' Appreciations of Practice

Conclusion 1: Each teacher has a coherent, distinct set of appreciations of science teaching practice that include perceptions of professional identity and views on preferences for practice.

Each teacher had a distinct view of himself or herself as an elementary teacher of science and these appreciations seem to find concrete expression in various aspects of the teacher's practice. Where, for instance, a teacher felt that he should be concerned about the cognitive development of each pupil in his class, that teacher saw himself as being the director of instruction, providing the necessary facts and skills from which his students could then draw understanding. This type of perspective was distinct from that of the teacher who, seeing herself as choreographer of classroom learning and activity, encouraged her students to engage in the pursuit of learning science and she organized and engineered opportunities for them all to have equal

chances of success.

Conclusion 2: These personal appreciations and practical preferences seem to contribute to a teacher's individual "style" of practice and these appreciations and preferences colour a teacher's goals for teaching and a teacher's expectations of self and of pupils.

Teachers are able to recognize and articulate what they see as their individual styles of practice. Style appears to be the expression of their appreciation, experience and commitment within a particular context. In interpreting contextual demands teachers use their own style of practice. Through individual styles and personal agenda for teaching, the teachers in this study were able to "personalize" their science teaching, stamping instruction with a unique, personal imprint.

The four teachers were found to have what they called their own style of teaching practice. Style instilled their practice with enthusiasm and vitality. Implicit in the term, "style" is a consideration of emotional, personal dimensions in their appreciations of practice. Both Elbaz (1983) and Clandinin (1985) have emphasized the personal dimension in teachers' knowledge. When Clandinin (1985) discusses the nature of teachers' images, she indicates that teachers' images are embodied in their experience and that, "their embodiment entails emotionality,

morality, and aesthetics and it is these affective, personally felt and believed meanings which engender enactments" (p. 363). Teachers' images, as described by Clandinin, attest to the recognition by teachers of the manner in which their personal appreciations influence and are played out through their teaching practice.

### 7.2.2. Comparability of Teachers' Appreciations and the Nature of Their Collaboration

Conclusion 3: While the distinctiveness of a teacher's appreciations suggest that each teacher has a unique style of practice, this does not preclude teachers from engaging in productive collaborative relationships with their peers in teaching science.

In this study, pairs of teachers established collaborative relations with each other in their practice of teaching science. This process of teacher collaboration itself stimulated discussion and analysis of pedagogy and this contact seemed to enhance a teacher's ability to recognize professional style and negotiate how to accommodate to various constraints of the setting. This suggests that collaboration is beneficial to teaching practice.

It is said that successful teaching calls for "of-the-moment"

responses in class and that this kind of expertise is characterized moreso by improvisational technique than by rigid adherence to previously planned routines (Dillard, 1986; 1987; Yinger, 1987). Schon (1983) would make connections between what he calls the "intuitive artistry" of teaching, that is, the improvisational nature of teaching and the capacity of a professional to reflect on action. His elaboration of the moments of the reflective process are presented elsewhere (Schon, 1983; 1987). It might be suggested that the teachers in this study did reflect on their teaching as individuals in their rooms and it is possible to speculate that their own styles of practice could well be connected to their in-class reflection. But, more importantly, each teacher was able to share reflections with a chosen colleague, by having opportunity for this in a collaborative relationship. It would seem that sharing reflections and having an opportunity to reconsider personal reflective thinking with a peer, may be a valued part of teachers' professional lives.

Some recent studies substantiate the view that teachers value collaboration. Cavers (1988) in an empirical study of teacher efficacy and school conditions offers support for the importance of teacher collegiality to teacher efficacy. His findings indicate that there is a difference in the way in which isolated and collaborative teachers treat students. Furthermore the more colleagial a teacher was, the less custodial that teacher was likely to be with pupils and the more likely it was that the

teacher would use effective teaching techniques. Riecken (1988) has shown that teachers tend to value for themselves the "learning" that comes out of teachers "putting their heads together, finding the best methods of getting the concepts and lessons across."

Conclusion 4: The nature of teachers' collaborative relationships can be influenced by the extent to which they share similar or differing appreciations of practice.

In this investigation, where a pair of teachers shared certain appreciations of practice, their collaboration was essentially cooperative. Where these teachers held differing yet compatible appreciations, their collaborative relationship was described as reciprocal and synergistic.

However, in either case, collaboration conferred on teachers definite professional and practical advantages. Through collaboration, these teachers could compensate for personal deficits in subject matter knowledge and enrich their pool of pedagogical preferences for instruction. Through collaboration, teachers could escape the isolation of their jobs and find colleagueship with a peer of similar status.

### 7.2.3. Teachers' Concerns about their Practice and the Significance of their Collaboration

Conclusion 5: In collaboration teachers appear to share three major areas of concern which relate to their services to their pupils, unit design and ongoing self-improvement.

Teachers' appreciations of practice seemed to indicate that there were three major areas of concern for the teaching of science. Firstly, the teachers who took part in this study tried to ensure that they provided their students with a level of instructional services appropriate to their perceived needs. Secondly, these teachers were concerned about designing units of science geared to meet their pupils' needs and interests, their own practical circumstances and their interests. Collaborating teachers tended to operate as design professionals. Thirdly, these teachers constantly sought opportunities for their own professional self-renewal in their day to day collaborative contact.

Central to all of these concerns was the extent to which a teacher saw himself or herself as a holder of the specialized knowledge of science. Clearly two views were prevalent in the sample, namely, teaching science as a generalist and teaching science as a specialist. The specialist was seen to have a satisfactory level of the specific skills and concepts of science

unlike the generalist who had a drawback in this respect.

It can be argued that teaching is about communicating and exchanging ideas. Teaching deals with conceiving, displaying and presenting ideas to an audience for whom this information may be new and not easily grasped. Teachers therefore need to have a rich source of ideas from which they can draw in teaching. But, where are these ideas to come from?

Often a textbook is the ultimate teacher resource. This tends to be true especially in the teaching of a subject such as science, where so many elementary teachers consider themselves to be poorly prepared and recitation from the text is a prevalent mode of instruction (Stake & Easely, 1978; Goodlad, 1984). "Theoretical knowledge provides another source of influence on classroom [teachers'] curricular choice" (Hawthorne, 1986; p. 25). However, in teacher collaboration, the most immediate and valuable resource is likely to be a colleague's own knowledge of the subject matter and related pedagogy. This blend of knowledge is not equivalent to "theoretical knowledge". It is much more valuable for it involves pedagogical knowledge and experience. Both categories of knowledge are essential to good practice (Shulman, 1986).

Shulman (1986) has outlined various categories of the knowledge base which he thinks teachers should have and he

concludes that the "teacher has special responsibilities in relation to content knowledge, serving as the primary source of student understanding of subject matter" (p. 9). He expects that teachers would also have "depth of understanding of the structures of subject matter".

Yet, it may be unrealistic to make such demands of teachers and in particular of elementary teachers. Many elementary teachers are trained as multi-subject generalists. They teach a variety of subject matter, a small part of which can be considered their specialty. Those who teach science feel uncomfortable with the subject and tend not to devote much time to science (Schmidt & Buchmann, 1983). Much of their repertoire and expertise of teaching is pedagogically oriented and for the most part learned on-the-job (Lortie, 1975; Buchmann, 1983). Teacher training has repeatedly been criticized for not being rigorous enough and in general of low standard and decidely unintellectual (Borrowman, 1965; Lortie, 1975). The lack of opportunities for on-the-job advancement or effective continuing teacher education is readily acknowledged too (Spencer-Hall, 1982; Sykes, 1983; Goodlad, 1984). Though research-based reform has been advocated, the question still remains, in the face of this mounting evidence of the inadequacy of professional preparation and support for teachers, what knowledge base can teachers be realistically expected to have and use (Housego & Grimmett, 1984)?

With weak preparation and inadequate institutional support teachers, specifically science teachers, are said to resort to over-reliance on curriculum materials to supply their knowledge deficits, making textbooks their "de facto curriculum" (Stake & Easely, 1978). It can be argued though, that because of the complexity and context-dependent nature of teaching, having content knowledge is not enough. What teachers need is an opportunity to translate and enrich whatever content knowledge base they bring into teaching, to meet their practical demands. Collaborative teaching has provided such a chance for the teachers in this study.

Conclusion 6: Teacher collaboration is a self-initiated, self-regulated strategy through which teachers can satisfactorily address their practical and professional concerns.

Lanier and Little (1986), in the most recent edition of the Handbook of Research on Teaching, report that "colleagial work adds to the pool of available ideas and materials, the quality of solutions to curricular problems, and teachers' own confidence in their collective and individual ability to refine their work" (p. 562). From the findings of this exploratory study, there is indication that in the absence of overwhelming educational or institutional support, teachers themselves recognize the need for ongoing self-improvement and they create strategies to counteract their professional deficits. Teacher collaboration is one such

strategy.

## 7.3. Implications

### 7.3.1. For Theory

Planning. The findings of this study suggest that planning occurs and recurs throughout the collaborative design process, as it becomes intertwined with the process of joint reflection on practice. This might indicate that teacher planning can be considered a reflective, intuitive process and not merely a deliberate, mechanical one. To say that teachers "appreciate" their science teaching in a certain manner is to suggest a wholeness about teachers' worlds, which the notion of preactive (planning) and interactive teaching phases does not convey. However, this was a study of a few specific cases of science teaching. More studies of teaching would be needed to find out the extent to which collaboration can enrich teachers' planning and moreover, whether a new focus on collaborative planning in teaching can have a direct bearing on the teacher's ability to improve mastery and coverage of instructional material.

Teaching as Worldmaking. The study has, by using the construct of appreciation, attempted to examine teaching as a whole, as a process of worldmaking, disregarding the tendency to divide teaching practice into preactive and interactive components. This

attempt was productive and therefore supports the conclusion that worlds of teaching are indeed intricate and cognitively complex. Much more extensive study of teacher cognition within a collaborative setting is likely to contribute valuable knowledge about teachers' worlds of practice.

An Epistemology of Practice. The ultimate goal of this study was to uncover and portray teachers' appreciations of practice, individually and collaboratively. It would appear that teachers valued those opportunities for reflection on practice occurring in collaboration. Such occasions allowed teachers to bring forward their own intuitive understandings of their work. Collecting teachers' intuitive understandings of their worlds of practice has the potential to contribute to an epistemology of practice that is less "technical-rational" than that which prevails in many educational institutions today (Schon, 1985). Practitioners are likely to find a less technically-oriented and more practically-based epistemology useful (Schon, 1987; Erickson, 1987).

### 7.3.2. For Practice

Professional Development of Teachers. It is true that experienced teachers themselves feel that they are in the best position to help each other (Yonemura, 1982). According to Peterson & Clark (1986), "the maturing professional teacher is one who has taken

steps toward making explicit his/her implicit theories and beliefs about learners, curriculum, subject matter and the teacher's role" (p. 292). Collaboration seemed to enable the teachers in this study to accomplish these ends. More opportunities for voluntary collaboration should be afforded classroom teachers.

From this study, it is evident that teacher collaboration can become a natural avenue for professional development and for continuing education of teachers. While it is still unclear how prevalent teacher collaboration is, there is indication that collaboration is of benefit to teaching practice and that peer coaching and cooperative teaching are useful models of school-based innovation (Cavers, 1988; Riecken, 1988). More institutional support should be given to teacher collaboration and this could also enhance the professional status of experienced teachers (Lanier & Little, 1986).

Teacher Preparation. The fact that teachers in this study did collaborate raises questions as to whether teacher isolation is as widespread now as it has been taken to be (Lortie, 1975). If on the other hand, collaboration is found to occur most often in the teaching of specialized subject matter such as science, this may imply the need for special programs designed to prepare teachers of such subjects. However, the instances of collaboration studied here were voluntary, between teachers of similar experience and expertise. Institutionalized collaboration may have different

results (Gaskell, 1988).

### 7.3.3. For Research

Motives for Collaboration. Further research is needed to establish what are teachers' motives for collaboration. While this study has given some indication of what these motives might be, more detailed study would be required so that, for example, school administrators might take such factors into account in staffing schools and providing for school-based professional development activity.

The Culture of Teaching. Insight gained from this exploratory study of teachers' practical and professional worlds of teaching would imply that there is merit in pursuing further studies of this nature. These are likely to contribute to a body of knowledge indicating that there might well be a "culture" of teaching (Feiman-Nemser & Floden, 1986). Deal (1987) defines culture as "a construct which helps explain why classrooms and schools exhibit common and stable patterns across variable conditions." "Internally", he says, "culture gives meaning to instructional activity and provides a symbolic bridge between action and results. It fuses individual identity and collective destiny" (p. 6). In particular, studies of collaborative relationships have the potential to point to the common vision of their worlds that teachers share and the strategies and tactics they exchange in

order to manage and resolve their professional concerns.

Teachers Researching Teaching. Teachers should be encouraged to cooperate with researchers in examining their own professional, collaborative relationships. This kind of action research has the potential to be of practical import to teachers and school administrators as well as to inform theory of teaching.

Context. Although not a specific focus or finding of this study, it is likely that certain features of the institutional context made it possible for the teachers in this study to collaborate. In a climate of active social change, it is commonplace for professionals to desire security. Further exploration of the connection between institutional setting and prevalence of collaboration is needed. What characteristics of school or administrative settings appear to facilitate, reward or hinder productive, voluntary teacher collaboration?

Gender. Collaborating teachers in this study happened to be male and female, each pair. To what extent is gender a significant variable in collaboration? This remains to be known.

### 7.3.4. Concluding Comments

If what was seen in the worlds of these teachers is any indication of what exists in the worlds of other teachers, then this study

points to the possibility of teasing out what may be called a "culture" of teaching (Feiman-Nemser & Floden, 1986). Views from various professional worlds of teaching can be woven into a version of a culture of teaching. This sort of perspective on teaching would be critical information for policy makers in education and for teachers themselves, who tend to feel that the scope of their practical knowledge has been neglected and not fully utilized (Elbaz, 1980). Yet, because this is still uncharted territory, so to speak, the findings of this kind of study still pose the danger of speaking for practitioners in a voice that might "confuse cultural description with prescription" (Feiman-Nemser & Floden, 1986; p. 505).

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# Appendix A

## Selecting an Appropriate Methodology for the Study

The concept of teacher appreciation evolved from the beginning to the end of the study and as the study wore on, ideas for the concept emerged and developed. I started off with a central goal of characterizing how experienced teachers of elementary science make sense of their practice. By observing how they operated in class and by having various informal and formal conversations with them throughout, I set out to gather the principles that seemed to underpin the essence of their teaching practice. What I needed was an appropriate methodological device for representing these principles such that the view of them which I present in this dissertation would reflect what occurred in actual practice.

Because of the constructivist perspective that underpins the concerns of this enquiry, I first turned to the repertory grid technique as a means of collection teachers' appreciations of their practice. I used a triadic method of construct elicitation. That did not work very well. The teacher constructs elicited for the repertory grid did not necessarily fit bipolar coordinates. Teachers did not respond well to the technique and it was viewed as being more limiting than freeing. Therefore, the grid was discarded.

What drew me to the concept of teacher appreciation was my conviction of the applicability of Schon's theory of reflective practice to the problem at hand. However, in his first book, Schon has not devoted much time and attention to discussing this construct. I, therefore, started off with a notion of appreciation as essentially the embodiment of the level of "know-how" which experienced practitioners display in practice. The critical point for me was that appreciation contained elements of thinking and doing in practice that were not assumed to be consequential or linear, but which could be intuitive or logical.

I had an opportunity to discuss the problem with Schon himself who referred me to Vickers and his discussion of appreciation. So, I resorted to a study of Vickers' notion of appreciation. Vickers (1983) provided further elaboration on the idea of appreciation and appreciative systems. His ideas provided a substantial methodological base for framing and using appreciation as methodological device.

Appreciation then became a means of teasing out, typifying and describing the ways in which teachers represent their worlds of practice. Conceptually, appreciation is related to "knowing-in-action" and for a teaching practitioner. This "knowing-in-action" is mingled with personal intuition and is informed by cases and examples of pedagogy, "gut feelings", preferences and concerns and select strategies, accumulated through practical interaction with the teaching content, students and colleagues. The teacher's appreciation of teaching science is in a sense, the canvas on which these many brush strokes mingle to produce the unique masterpiece that is that particular teacher's practice. Methodologically, appreciation represents the basis of the practitioner's operation-in-practice.

Out of this investigation has come a conception of teacher appreciation derived from Schon and Vickers but one which is particularly applicable to this study. Consistent with the theory that persons construct their own realities, a teacher appreciation is "a representation of the professional identity and practical preferences of a teacher, drawn from intuition, experience and that teacher's own understandings of practical situations."

# Appendix B

## Background Information on the Teachers

### Teacher Personal History

Biographical Information

Name Dick Age 38 Sex M

School X

TEACHING CREDENTIALS/DEGREES

| (Date) | (Degree) | (Institution) |
|---|---|---|
| 1970 | B.A. | England |
| - | Certificate in Education | England |
| 1977 | M.A. | U.B.C. |

OTHER COURSES/WORKSHOPS/SEMINARS

Graduate Course on Research in Education

Social Studies Workshops

Science Workshops

| TEACHING EXPERIENCE | | (GRADES) | (SUBJECTS) |
|---|---|---|---|
| TOTAL 10 years | AT THIS SCHOOL | 2, 3, 4, 5 | all |
| | IN THIS DISTRICT | 4, 5, 6, 7 | all but Mu/Art |
| | Other (specify) | Teaching Asst. | Social issues in Education |

NON TEACHING RESPONSIBILITIES (school, district, professional associations, community ...)

Executive of Cantata Singers

Supervision - lunch hours/recesses/1 hr./wk.

District science committee

Appendix B (contd.)

Background Information on the Teachers

Teacher Personal History

Biographical Information

Name Donna Age 39 Sex F

School X School Y

TEACHING CREDENTIALS/DEGREES

| (Date) | (Degree) | (Institution) |
|---|---|---|
| 1971 | Diploma (Early Childhood Education) | B.C. |

OTHER COURSES/WORKSHOPS/SEMINARS

S.S. Workshop

TEACHING EXPERIENCE

| | | (GRADES) | (SUBJECTS) |
|---|---|---|---|
| TOTAL 10 years | AT THIS SCHOOL | 1-4 | All |
| | IN THIS DISTRICT | Kindergarten | |
| | Other (specify) | | |

NON TEACHING RESPONSIBILITIES (school, district, professional associations, community ...)

Supervision (lunch - 1 hr.); recess - 15 min. per week

Housing Cooperative Member

Swimming

Parent

Appendix B (contd.)

Background Information on the Teachers

Teacher Personal History

Biographical Information

Name Jack Age 30-40 Sex M

School Y

TEACHING CREDENTIALS/DEGREES

| (Date) | (Degree) | (Institution) |
|---|---|---|
| 1971 | B.Sc. | B.C. |

OTHER COURSES/WORKSHOPS/SEMINARS

| | |
|---|---|
| 5th Yr. Professional Certificate | 1973 |
| B.C. | |
| | |

| TEACHING EXPERIENCE | | (GRADES) | (SUBJECTS) |
|---|---|---|---|
| TOTAL 9 years | AT THIS SCHOOL | 5/6/6 | |
| | IN THIS DISTRICT | | |
| | Other (specify) | | |

NON TEACHING RESPONSIBILITIES (school, district, professional associations, community ...)

Audio-visual committee

Consultative committee

District science committee

Appendix B (contd.)

Background Information on the Teachers

Teacher Personal History

Biographical Information

Name Jessica Age 40-50 Sex F

School Y

TEACHING CREDENTIALS/DEGREES

| (Date) | (Degree) | (Institution) |
|---|---|---|
| 1966 | B.A. | B.C. |
| 1971 | M.A. | B.C. |

OTHER COURSES/WORKSHOPS/SEMINARS

| | |
|---|---|
| Science Spectrum - Yearly | 1973 |
| Marine Biology | |
| PD workshops | |

| TEACHING EXPERIENCE | | (GRADES) | (SUBJECTS) |
|---|---|---|---|
| TOTAL 9 years | AT THIS SCHOOL | 4, 5, 6, 7 | |
| | IN THIS DISTRICT | several | |
| | Other (specify) | | |

NON TEACHING RESPONSIBILITIES (school, district, professional associations, community ...)

Gives PD workshops/district

District Language Arts/Science Committees

# Appendix C

## Schedule of Teacher Interviews

School X

| Phase | Teacher | Type of Formal Conversation | Time | Unit |
|---|---|---|---|---|
| 1 | Dick | single-subject | February - Year 1 | Machines |
| 2 | Donna<br>Dick | single-subject reflective<br>single-subject reflective | June - Year 2<br>June - Year 2 | Systems of the Human Body |
| 3 | Dick and Donna<br>Dick and Donna | multi-subject interpretive<br>multi-subject interpretive | early June - Year 2<br>late June - Year 2 | Systems of the Human Body |

School Y

| Phase | Teacher | Type of Formal Conversation | Time | Unit |
|---|---|---|---|---|
| 1 | Jack | single-subject | January - Year 1 | Volcanoes |
| 2 | Jack<br>Jessica | single-subject reflective<br>single-subject reflective | May - Year 2<br>May - Year 2 | Systems of the Human Body |
| 3 | Jack and Jessica<br>Jack and Jessica | multi-subject interpretive<br>multi-subject interpretive | late May - Year 2<br>late June - Year 2 | Systems of the Human Body |

# APPENDIX D

## SAMPLE PROTOCOL -- INTERVIEW II

Teacher X School Y

1. I have heard you talk about "your way" of teaching science. Tell me all about your way. What is unique about it?

   Probes: Use/development of: programme; planning and preparation; curriculum objectives, topics, materials; conducting this class and others, routines, rules, procedures, expectations, tasks, work; other considerations.

2. How does your way of teaching science compare with your way of teaching other subjects? Why?

3. How did you arrive at this particular way of teaching science?

   Probes: What kinds of things do you think of before this class? How do you decide what to do before class, in class, with this particular group..? Which aspect of your teacher training programme has been most valuable for your present job as a science teacher?

4. How do you feel about your science teaching? What works well? Not so well? When? Why?

   Probes: Why do you think this an appropriate way to teach science? What do you hope to accomplish by teaching this way? Are you usually able to achieve these goals? Why? Why not?

5. When you think of yourself as a science teacher, what do you consider to be your job?

6. What is it like to teach (science) at this school?

   Probes: Are there persons at this school who have input in your science teaching...Are there factors here that make your science teaching especially pleasant, unpleasant...Any special problems? (resources, equipment, texts)

7. What do you expect of your students?

   Probes: Do your expectations differ for different students? How? Are there "special" students in your science class? How do you cope? How do you get them to do what you expect of them?

# APPENDIX E

## SAMPLE PROTOCOL -- INTERVIEW III

Teacher X School Y

This introspective-interpretive interview differs substantially from Interview I. The first interview is intended to prepare the ground, so to speak, for the second. In the latter the interviewer is more facilitative, attempting to orient the conversation so as to assist the teacher to exemplify, clarify, extend and interpret the responses provided in the first phase of interviews.

Consequently the pattern of interaction between interviewer and respondent is not only less predictable than that of Interview I but also quite different ~~from~~ for each respondent. As a result of this conversation the interviewer hopes to verify teacher constructs which underpin these two broad questions:

> How do you balance personal and other considerations in preparing for your science classes?
>
> To what extent do your lessons reflect your personal bias, the classes you now teach and the school you're at now?

# Appendix F

## Guidelines for Classroom Observation of Teaching

### Beginning

Where does the lesson occur (classroom, laboratory, out of doors?)

How are the students organized for instructions:

(Whole Class -- How are the majority of students attending to the teacher?
Group -- Students are divided into separate groups with the teacher moving between groups.
Individual -- Students involved in independent work with teacher generally available for help.
Other -- combinations or unique situations.)

How does teacher indicate start of activity and move students into position?

[--Systematic?
--Students used?
--Time used? (delays?)]

What is the general subject for the lesson? What is the specific content? (electricity, characteristics of living things...)

### Middle

What method is chosen for imparting the information?

(discussion, lecture, group presentation, experimentation, other?)

What interaction patterns occur within the lesson? (Teacher-Student; Student-Student)

(Are students selected randomly, in any specific order, or are volunteers chosen? Are any sections of the class ignored?)

What is the effect of the above on the progress of the lesson?

### End

What is the method for concluding the lesson?

(test, summary, disorganized breakup, etc.)

...adapted from Doyle et al, (1982)

# APPENDIX G - Sample Observation Narrative and Specimen Field Notes

Classroom Observation

Specimen Narrative Record

Teacher X School Y

Twenty-five Ss enter noisily. Teacher is standing arms folded, against the blackboard near $T_4$. This class is being held in the lab. (See specimen plan of room for position of $T_4$ [table 4]. Teacher announces in a loud, pleasant voice, trying to indicate surprise, "Oh, are we noisy! I'm going to use your bodies today in science. I want you to cooperate." Ss move more quietly to their tables. Still noisy.

T - "Are we ever noisy. I'm not doing anything until the tone drops. First of all, about the time-table next week...." By this time Ss are all settled at their tables and listening to T who has moved towards the middle of the room near to the T desk. "...We go off time-table on Friday. We will lose more than two periods by next Friday. What I'm looking at is your work. You should be at around 19 or 20 then. How many people would be there by the end of today?" A few Ss put their hands up (about 5 or so). T -- "Let's take one second to go through your notebooks, just in case you lose your notebooks in January...Make sure you don't leave it here or lose it. Put it away safely...On January 3 when you come back I'll say, one week from now I

Appendix G, con't.

want your notebook. If you lose your notebook, what happens?" Sg at $T_1$ puts hand up and answers (not clear). T -- "Well, you'll get to do Lab 2 again." No complaints. Ss quiet. Still apparently listening attentively. T then starts to review his expectations of their work for questions 1 to 20. T -- "Number One, you should have a nice diagram drawn. It should be labelled what?" T calls on Jane -- No response given. T says to J, "Look at the lab sheet." (Apparently Jane was not following on.) Then T asks Brian who lists Lugos solution, microscopic field, power (400). T then asks class, "What would be wrong with writing 'x 40'" (uses b.b.). T gets one correct answer and repeats, "Yes, that could be low power." He then reminds Ss to use his "mystery code, X" for labelling any part of the onion block which has been seen under the microscope but not clearly recognised. He also stresses that labelling must be done in ink and students must be sure to underline the heading for that lab. He then briskly moves on to Question 2. What does h.w. mean, homework or hair width? Q.5. Ss must remember to use complete sentences. Same for 7 and 8. T gives example of answer for Q.9 -- "When I added Lugos solution to ____ I noticed...." T then reminds them to use their microscopes properly (focus, stains). Q.11, 12 stresses again that complete sentences must be used and answers include details. Re: Q.12 T -- "Write all the things you could

Appendix G, con't.

think of...Obviously water won't work as a stain. Why not?" Takes a few replies -- Ss seem to get the meaning but are using layman's language. T -- frowning -- "What are the words we used in Gd 4....We talked about translucent and...." S -- "Transparent." T -- "And?" S -- "And opaque." T -- "What's opaque?" T gets satisfactory answer and moves on. Q.13 -- diagram of one block. Q.14 -- complete sentence ..."What I saw in plant E was..." Q.16 -- "What I think is moving in plant E is..." Give it a name or describe it! Q.17 -- There are three correct alternative answers that he's looking for. Q.18, 19 -- Asks for a show of hands to find out how many Ss could come up with answers to those difficult ones. Q.20 -- Be sure to explain why it moves one way or another. "Don't say, because it's Friday...." (Some S's amused.) "You have to give good scientific reasons. Don't say it moves because I saw it move. What's wrong with that?" (Rhetorical) "You've got to say something. You've got to figure out a scientific reason. If you're finished at the back will be my fantastic experiment. This will work for about six hours if I did it properly. Try to figure out why they go up? What are the things in the jar, everything?" He then tells Ss that he'll give them "the code" next Thursday. It seems that he expects them all to have looked at the

Appendix G, con't.

jar by then and have figured out its contents and a possible explanation for their behaviour. The jar is a large covered jam jar containing a green liquid with white spheres floating up to its lid and then down again. It is now about 11:00 and he finally moves into the day's activity. Ss are supplied with toothpicks, to scrape off the insides of their cheeks and make three different mounts of the cheek cells. T humourously reminds them to use the blunt end of the toothpick to avoid hurting themselves. He also demonstrates using slide and cover slip. He encourages those Ss who need to, to spend the next hour ot so on Q.18, 19 in order to get a "fantastic mark" since he is "more concerned that you do quality work." He invites questions from the class and sends them off to work. Four or five Ss question T near door.... (This class ended at 12:00 noon).

Appendix G, con't.

Specimen Field Notes/Observation

Day One -- Memo -- Teacher X -- School Y

I entered the room after the bell, about 3 minutes after the pupils. Took a few minutes for me to settle down in my corner and orient myself. This put me at a distinct disadvantage. I should have "cased the joint" before the bell, "set up shop" and stayed there to see them enter.

I only observed one class this morning. Seems that the observer needs some time to "wind down" after each session. Teacher is anxious to chat during observation. Comments are of substantial value -- about certain students, aspects of the lesson and how they're handling what he wants them to do. Have to focus my observation more. Difficult to capture even in observation notes the fullness of the students' remarks to each other while they work, their engagement, the teacher's movement and his interaction with them. Seems that he moves like a whirlwind. How does he manage to check on each table repeatedly, chat with special students, handle problems with equipment and supplies, and chat with me -- frequently -- all in the same class. The students seem so excited and busy -- really working too!

Note: Later on in the study these memos became more reflective, including insights, feelings, reactions and interpretations, hunches and questions resulting from the researcher's interaction with the setting and the participants themselves.

Appendix G, con't

Teacher X School Y

Specimen Description of Classroom/Lab

Classes are conducted in the science laboratory regularly. Tests, debates, lessons that involve no specimens or specialised equipment are held in class. This room is large, bright and sunny. It is shared by two teachers at that school. There are potted plants hanging from the ceilings and also on the shelves near the windows. Some of them are in bloom.

On the wall above the bookshelves there is a large coloured photograph of a family of foxes. Around and above that there are posters bearing the names of the disciplines that comprise science, each in a different colour for, eg., Botany, Biology, Zoology, Physiology, Physics.

The room is furnished with 6 large tables, moveable stools and chairs, a teacher's desk, two single desks near the teacher's desk and several bookshelves. Textbooks and miscellaneous texts are stored on the shelves. Along the counters there are jars of preserved specimens and boxes for glue, plastic beakers, funnels, etc.

At the back of the room there are four large coloured photographs of animals. On that counter, several microscopes are stored, in their plastic hoods, some of them covered in plastic shopping bags. A human skeleton hangs on the west wall above the counter, labelled, "Observe the skeleton without

Appendix G, con't.

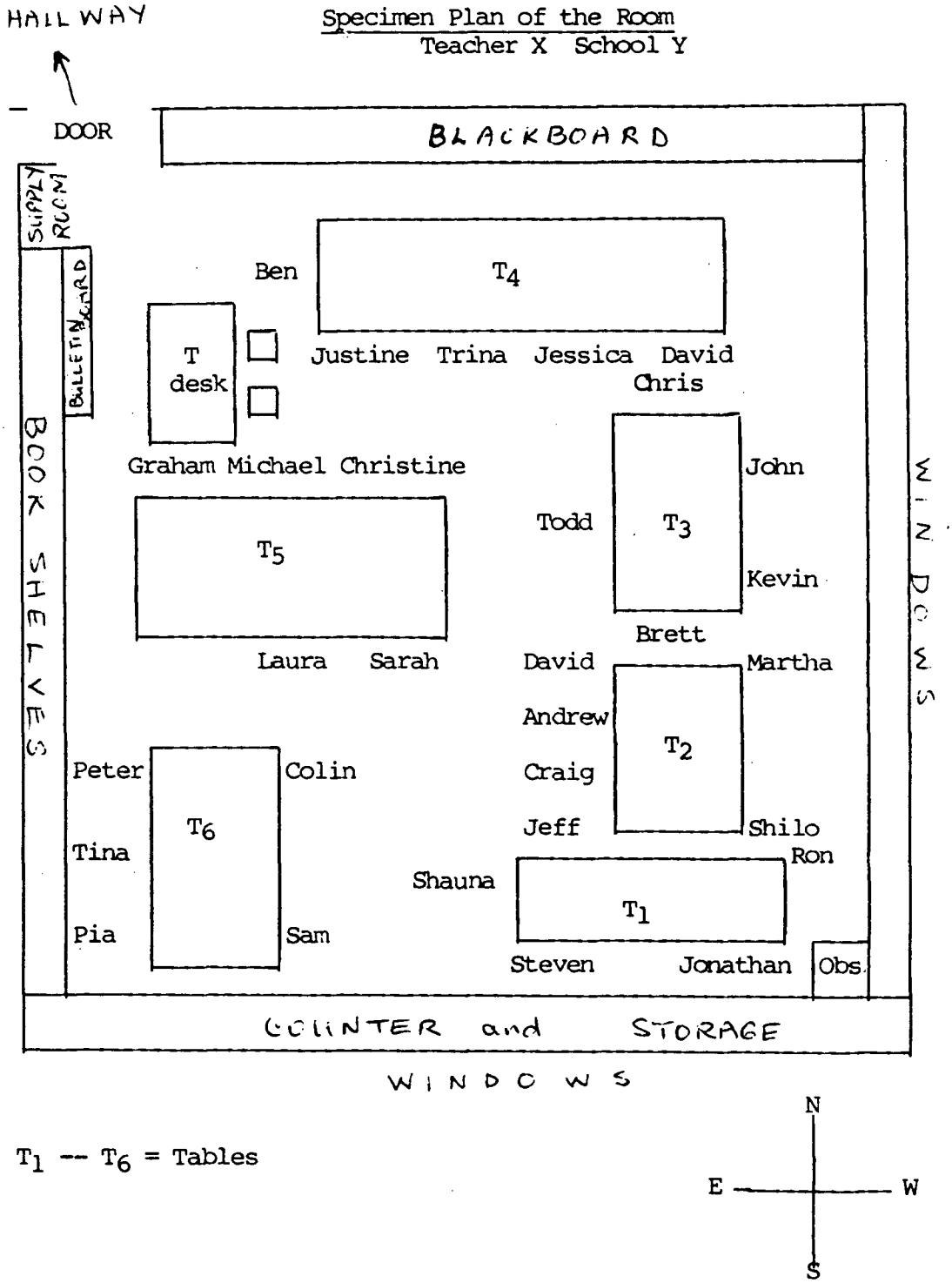
touching." There are more animal photos on that wall, coloured and black and white.

A bulletin board hangs on the wall in the corner near the T desk. It seems to be well used with up-to-date newspaper clippings, various lists, a calendar. Some coloured "photograms" are posted in that corner too. A podium and microphone stand against the west window not far from the skeleton.

The floor is clean (usually before and after class!). The room is tidy, warm and pleasant.

Appendix G, con't.

Specimen Plan of the Room
Teacher X School Y




$T_1$ -- $T_6$ = Tables

Appendix G (contd.)

Specimen Field Notes

My View of Dick's Class

I remember well the sense of mild chaos that always greeted me in this room. I have to acknowledge right away that my tolerance for noise in classrooms is somewhat low. I am willing, however, to discriminate between the many sorts of noise one hears in a classroom, between the buzz of a group at work, the din of an unruly bunch coming in or leaving or changing from one activity to another and so on. Despite the different groups of kids that inhabited this room during the time I spent with this teacher, the noises in this room seemed to stay much the same. There seemed to be so much going on that I did not feel too guilty slipping in and out. They treated me as though I did not exist. Perhaps they had grown accustomed to so many interruptions that I did not have to work too hard at being unobtrusive. Most of the time, though, there was a smooth constant rhythm of activity. Kids working quietly, then getting up to chat with a friend, to leave the room, for some reason or the other. Some pupils tended to move around more than others. I never did figure out how that was really controlled or whether it was meant to be. But there was an atmosphere of tolerance, and so I felt at ease there. Yet, at the end of many a session in that class I was tired and irritable, more so than in any other room and I didn't feel that I could come up with a particular reason for my irritability.

I observed two units of science in this room, the first on Machines and the other on the systems of the Human Body. This counted for all the science done in that grade that year.

You won't see rows of desks in this room and it is rare to see the teacher sitting at his desk. The room itself is large, airy and full of light. There are windows all along the long wall with a door to the playing field in one corner. The opposite wall is broken by two doors, one at each end, leading to the corridor which connects the primary wing to the main building. Across the hall is a Grade three room. That is his colleague's room. He himself has a three/four split.

The desks are arranged in clusters facing the blackboard. There is a carpeted area in the middle of the room in front of the blackboard. For science, when they are doing activities, they work in groups at the art table at the back, in the reading corner and on the carpet. On the whole, there is an air of comfort, the sort of warm, cluttered, lived-in feeling of a teenager's room. This class is a hive of activity. They are all busy doing something. It is at first quite difficult to clearly see what. Often they are not all working at the same thing but they are all busy, seriously engaged doing whatsoever it is. The teacher can frequently be found kneeling at the desk of one pupil or responding to the enquiries of one or two near the carpet. He, too, is busy, moving continually among the desks checking, chastising or offering assistance.

Appendix G (contd.)

I sit in classrooms often, mainly to observe and help beginning teachers improve their practice. Sometimes, in a new room before I begin to record hard data on what I am there to observe, I just sit and "take in" my surroundings. I remember once thinking how much like a shepherd a teacher operates. The whole herd of sheep is easily driven along but the stragglers test the shepherd's skill and expertise in herding. Really, the task is to keep the stragglers on-stream with the rest of the herd. This is troublesome. Doing it well seems to require more than a sharp eye and quick reflex. A good shepherd has eyes all around. He "senses" rather than "sees" the straggler almost at the moment he decides to wander off-track. By a quick, skillful maneouver the straggler is brought into the mainstream. The job is to keep the herd all moving along together, anticipating and "nipping in the bud" any tendency to stray off-course. Without the stragglers, the job might be routine.

So, too, in this classroom certain pupils "jumped out at me" when I observed the large group. I am going to discuss the teacher's dealings with one of these "extraordinary cases". Through these unique cases and the handling of their "off-track" situations, I could better gain insight as to how the teacher framed his/her role.

A significant number of unpredictable events in class seem to centre around the activity of these extraordinary or unique cases. Dealings with the rest of the class are more routine and consistent. Dealings with these other pupils are time-consuming, sometimes distracting to the whole group, challenging to the teacher, requiring improvization, intuition, "know-how" and the cumulative weight of personal teaching experience. Handling these unique cases, Schon would claim, requires "artistry".

This was a split 3/4 grade, with more than half the class boys. Of 30 on the register, 17 were boys. Of all the classes I observed, this one had, I think, more than a fair share of unique or special cases. About five of these pupils, I think, treated themselves specially and the teacher seemed to make allowances for them. I reread the observation narratives their names appear time and time again.

I was first drawn to C, not because he sat in any particular spot in the room. He was not too far from the teacher's desk. He just stood out. He worked at his own pace and he required the teacher's attention at odd times. I remember on one occasion the teacher asked C to hand in a worksheet that the others had already turned in. He took about five minutes or more to get it. The teacher just carried on asking questions, conducting his class while C poked around, sulked, shoved his partner, rummaged around under the desk, emptied what seemed to be the entire contents of the desk and finally found the sheet. By this time the teacher was on the carpet working with a group and C stumbled up and sulkily shoved a sheet of paper at him. The teacher accepted it with thanks and continued working. Neither the teacher nor the other pupils seemed to notice anything odd about this episode.

Appendix G (contd.)

Through all of this I had the uncanny feeling that I was alone in my consternation. Perhaps it was taken for granted that C would act this way. Later on that day, Dick, Donna and I were chatting. The conversation turned to the "kids". I asked about C. Dick said that he was very eager to please and to do things right and that he kept on asking questions and he kept on answering him. Donna added that in supervision he, C, can "just swallow you up". Dick went on to explain that he had no idea how C did any work but he showed me C's sheet and it was obviously painstakingly done, and very well done compared with the others he showed me.

Specimen of Teacher Activity Sheet for Teaching The Skeleton and Muscular System which Dick and Donna used as a guide for part of the unit.

The main facts we learned about the skeleton and muscular system, from the textbook, are:

- The skeleton is a system of bones, like a frame, holds up body
- Bones protect body, help us move
- muscles pull on bones
- bones move at joints
- cartilage between bones protects bones from bumps, soft
- muscles all over body, under skin, joined into fibers
- almost all movement comes from contraction
- muscles work in pairs one relaxes the other pulls
- voluntary muscles you move, stomach, heart, breathing, muscles work themselves involuntary

More facts we learned from the field study are:

3 "Things to Try," that show how the skeleton and muscular system works, are: (Give the experiment a title and explain the method.)

A. P 105 #2: Experiment title: The ball and socket shoulder

Method: - Hold your arm straight out

- Move it in a circle

- Find what other ways you can move your arm while keeping it straight

Results/Conclusion:

B. p. 110 #1: Experiment title: Arm muscles work in pairs

Method: - Put your palm under the desk push up

- Put your other hand on your upper arm and find which muscles are working - front to back

- Put your first hand on the desk, palm up, and push down

- Again feel your upperarm, which muscle hardness, fr./back

Results/Conclusion:

C. p. 111 # : Experiment title: People as muscles (4 people write a letter)

Method: - Tie 4 strings on to the top of a pencil

- Tie 4 strings on to the bottom of a pencil

- 4 people take 2 strings each, a top and bottom one

- work together to try and write a letter by carefully pulling the strings

Results/Conclusion:

Presented by:

Appendix H (contd.)

Specimen of Matching Pupil Activity Sheet (Dick and Donna)

The _____ System Sheet

The main facts we learned about the skeleton and muscular system, from the textbook, are:

_____

_____

_____

_____

_____

_____

_____

_____

_____

More facts we learned from the field study are:

_____

_____

_____

3 "Things to Try," that show how the skeleton and muscular system works, are: (Give the experiment a title and explain the method.)

A. p. # : Experiment title: _____

Method: _____

_____

_____

_____

"Things to Try"

B. p. # : Experiment title: _____

Method: _____

C. p. # : Experiment title: _____

Method: _____

Presented by: _____ _____

Specimen Pupil Record of Notes for Speech used by Dick's class

MY ONE MINUTE SPEECH

FOR _____ (Date)

TOPIC _____

THE THREE MAIN THINGS I WANT TO SAY ARE:

#1 _____

#2 _____

#3 _____

THE KEY WORDS FOR MY SPEECH ARE:

For #1 _____
_____
_____

For #2 _____
_____
_____

For #3 _____
_____
_____

(Use rough paper to plan your speech in more detail. This is just for the notes you should use during your talk.)

Appendix H (contd.)

Instructions to Pupils Written by Donna on her blackboard

1. Form a circle with your group.

2. Group leaders will ask members to read out loud their main facts they collected from their homework last night.

3. The group decides which facts will be put on the final draft. (Raise your hand to do this.)

4. The group leader puts the facts on the sheet.

5. Decide how your group is going to present its system to the class.

| | |
|---|---|
| chart? | pictures |
| books? | models |
| filmstrips? | |

6. Decide what experiment you will have the class try. Assign jobs for your presentation.

Appendix H (contd.)

Jessica's Anatomy Test, Grade 7

Name _____

Date _____

Total _____ /50 _____

PART A: MATCHING (Use each number only ONCE)

| | | | |
|---|---|---|---|
| 1. | cell | _____ | blood away from liver |
| 2. | papillae/taste buds | _____ | largest gland of body - stores sugar |
| 3. | alimentary canal | _____ | womb |
| 4. | stomach | _____ | contract only |
| 5. | epiglottis | _____ | filter |
| 6. | esophagus | _____ | stomach, intestine, skin, blood vessels |
| 7. | hepatic vein | _____ | cooling mechanism |
| 8. | large intestine | _____ | fight bacteria |
| 9. | cell membrane | _____ | thinking portion of the brain |
| 10. | lachrmal gland | _____ | carry oxygen |
| 11. | liver | _____ | sperms |
| 12. | kidney | _____ | digestion from mouth to anus |
| 13. | urea | _____ | semi-permeable (lets some molecules through but not others) |
| 14. | dermis | | |
| 15. | sebaceous gland | _____ | closes windpipe |
| 16. | skin | _____ | skull joint/most complex in body |
| 17. | sweat | _____ | links brain to all parts of the body |
| 18. | placenta | _____ | produces insulin |
| 19. | amniotic sac | _____ | contains blood vessels, nerves, fatty tissues |
| 20. | uterus | | |
| 21. | semen | _____ | passage for food in throat |
| 22. | smooth muscles | _____ | tears |
| 23. | cardiac muscles | _____ | HCI (gastric acid) pepsin |
| 24. | muscles | _____ | eggs |
| 25. | nucleus | _____ | electrical impulses |
| 26. | pancreas | _____ | atrium, ventricles |
| 27. | testes | _____ | sweet, sour, salt, bitter |
| 28. | ovaries | _____ | 70 million sperm/$cm^3$ |

Appendix H (contd.)

Jessica's Anatomy Test, Grade 7

PART B. MATCHING

| | | | |
|---|---|---|---|
| 1. | Parkinson's disease | _____ | excessive use of a muscle |
| 2. | greenstick fracture | _____ | liver disease caused by alcohol |
| 3. | ringworm | _____ | too many white blood cells |
| 4. | kidney stones | _____ | fungi |
| 5. | venereal diseases | _____ | nerves cause muscles to shake |
| 6. | tendonitis | _____ | water not reabsorbed by body |
| 7. | muscular dystrophy | _____ | body doesn't produce insulin to handle sugars |
| 8. | multiple schlerosis | | |
| 9. | cirrhosis | _____ | hairline cracks |
| 10. | diarrhea | _____ | wasting of muscles |
| 11. | diabetes | _____ | balls of mucus |
| 12. | leukemia | _____ | several sexually transmitted diseases |
| | | _____ | destruction of myelin sheath around nerve |

Jessica's Anatomy Test, Grade 7

| | | | |
|---|---|---|---|
| 29. | heart | _____ | extracts water, hardens food to waste |
| 30. | white blood cells | _____ | allows circular movement |
| 31. | red blood cells | _____ | covers, protects, regulates temperature, expels toxins |
| 32. | ball & socket joint | | |
| 33. | mandibular joint | _____ | cell growth and reproduction |
| 34. | eye | _____ | source of 4/5 of what we know |
| 35. | cerebrum | _____ | hair follicle |
| 36. | neurons | _____ | heart muscles |
| 37. | cerebellum | _____ | regulates heart beat, respiratory rate, perspiration |
| 38. | spinal cord | | |
| | | _____ | waste product |
| | | _____ | contains foetus, water, umbilical cord |
| | | _____ | food for baby |
| | | _____ | basis of life |

Jack's Anatomy Test, Grade 7

Name _____

Date _____

Total _____ /50

PART A: MATCHING (Use each number only ONCE)

| | | | |
|---|---|---|---|
| 1. | nucleus | _____ | filters waste from the blood |
| 2. | aorta | _____ | "trapdoor" of trachea |
| 3. | testicle | _____ | thigh bone |
| 4. | bladder | _____ | holes in skull for ears, nose, mouth, eye |
| 5. | eye | | |
| 6. | femur | _____ | male reproductive organ |
| 7. | cerebrum | _____ | tears (moistens eyes) |
| 8. | semen | _____ | white blood cells |
| 9. | epiglottis | _____ | DNA/chromosomes |
| 10. | heart | _____ | largest artery in the body |
| 11. | lachrymal gland | _____ | smell messages to the brain |
| 12. | epidermis | _____ | kneecap |
| 13. | liver | _____ | brain part which regulates heartbeat, respiration, perspiration |
| 14. | vertebrae | | |
| 15. | mitochandria | _____ | encloses heart/prevents heart from rubbing against lungs and chest |
| 16. | erythrocytes | | |
| 17. | olfactory nerves | _____ | power producer of a cell |
| 18. | mandible | _____ | hair follicle |
| 19. | Fallopian tube | _____ | voice box/vibrates |
| 20. | bronchi | _____ | photoreceptors/optic nerve |
| 21. | alveoli | _____ | ilium, ischium, pibis bones |
| 22. | kidney | _____ | main branches at end of trachea |
| 23. | pericardium | _____ | place where fertilization of egg occurs |
| 24. | skin | _____ | gastric juice |
| 25. | patella | _____ | pulmonary, aortic, tricuspid mitral valve |
| 26. | villi | | |
| 27. | cerebellum | _____ | connects kidneys to bladder |
| 28. | leucocytes | _____ | another name for upper skin layer |

Appendix H (contd.)

Jack's Anatomy Test, Grade 7

| | | | |
|---|---|---|---|
| 29. | stomach | _____ | secrete hormones/ductless |
| 30. | orifices | _____ | memory, learning part of brain |
| 31. | sebaceous gland | _____ | stores sugar (glucose)/stores glycogen |
| 32. | ureter | _____ | almost waterproof/regulates body temp./ prevents bacteria |
| 33. | endocrine glands | | |
| 34. | nerve cells | _____ | red blood cells |
| 35. | pelvis | _____ | swells/holds waste products |
| 36. | larynx | _____ | mucous, sperm |
| 37. | umbilical cord | _____ | spocrine, eccrine/(kinds) |
| 38. | sweat glands | _____ | attaches baby to placenta |
| | | _____ | lower jaw/jawbone |
| | | _____ | fingerlike projections in small intestine walls |
| | | _____ | neurons/create synapses |
| | | _____ | spinal column |
| | | _____ | air sacs |

Total /38

Appendix H (contd.)

Jack's Anatomy Test, Grade 7

PART B. MATCHING

| | | | |
|---|---|---|---|
| 1. | heart disease | _____ | salivary infection |
| 2. | Simmonds | _____ | parasite eggs in skin |
| 3. | metabolic diseases | _____ | breathing painful and difficult |
| 4. | Alzheimer's disease | _____ | glandular diseases; tired feeling |
| 5. | gallstones | _____ | neurons of brain all fire at once/ seizures |
| 6. | mumps | | |
| 7. | acne vulgaris | _____ | uncontrolled trembling, muscles shake |
| 8. | pleurisy | _____ | arterioschlerosis |
| 9. | epilepsy | _____ | dwarfness |
| 10. | mononucleosis | _____ | serious memory loss |
| 11. | scabes | _____ | bilicary calculi/calcium, bile salt, cholesterol |
| 12. | Parkinson's disease | | |
| | | _____ | infected blackhead |
| | | _____ | excess of one chemical |

Total /12

Jess: Grade six, on our electrical unit, they have to do an electromagnet and we say to them, " You've got one nail. It will pick up pins. Which end is north? Which end is south?" And they, when they don't know it, I say, "You have a problem to solve." Well, then some of them think of a compass eventually. Once one person thinks of it, you know of course... But I 've had youngsters, I said,"Think back to your magnetism because you need to know that information, that knowledge in order to answer this question." They say, "I swear, " I've never had magnetism in my life." They've had two months of it with me in grade four and by grade six they do not know they have ever had magnetism. So I tend not to worry about the knowledge, the body of knowledge...

Jack: You can also go look it up...

Jess: I tend not to worry about the body of knowledge as much as ...

Int: So what is it that you're concerned about?

Jack: I think an attitude, probably it's the most important thing to have...

Jess: Liking science and using science techniques to face problems and solve problems and look at science not as something separate in a couse in school. They hate it in high school. they come back and tell us ..

Int: Why is this?

Jess: Because they have to go through a textbook from page one to page ten. There are no experiments. They are always, "Here's the problem, get to the right answer." There is nothing where you get your answer or you face a problem and you solve it in some way. There's no variation in high school; there is the problem, get to the end. And it's all cookbook stuff.

Int: There was one other thing that I noticed so far quite different. It is that there's a lot of interaction between you (Jack ) and the kids during the course of the speeches and your interaction (Jill) seems to come in at the end.

Jess: Well I would like them to handle, again it's the same thing, isn't it? Get yourself ready, get yourself organized. You're responsible for this. You handle the questions. Unless somebody's really rude, I wouldn't interrupt the talk. I would let them do their, what they have in their mind.

Int: But I wasn't talking...

Jack: You mean after the speech?

Int: I'm talking about things like, you ask them questions about spelling. I notice there's a preoccupation in both classes about terminology...

Jack: Yes, I can see it from the kids' point of view...

Jess: (like a student) What word is that he's trying to say?

Jack: I also know they don't know how to pronounce it and I don't blame them. I keep thinking, like X who's sitting in front of me will say, "Oh, it's that one!"

Jess: Like P today, with "perisis", "perisis" instead of "peristalysis" and "cirrhosis" - I knew what he meant and I thought kids should be aware of that word as a vocabulary word, not spelling. Not spelling, vocabulary.

Int: But you see, Jack does a lot more of that than I see you doing...

Jack: But also because there's another reason. Well in my case, it's probably because I've never done it with these kids before. This is the first time I've ever done this. I've never done it with the students. You probably wouldn't know that by me being there, but I've never done the systems with these kids before in the school. So, and I also know that I have to [end of side one]...give them a test. Now Jill she has the idea, whereas I have nothing. I am sort of, I'm trying to piece it together for the first time. It's like asking me the first time I did the astronomy speeches, I had to think about what I wanted. Now I just lie back and go, "They're going to say this and this." And I know they'll probably, and if they don't comment on that I will and they've got it all together. This is the first time I'm doing this. That's why I'm asking more myself because when they say these words and they don't pronounce them, I think I've got to make up the test and I've got to make sure I've got the right facts before I put them on the test. Thus, part of it is for my own benefit and that's why I'm probably asking so much.

Int: I also wondered if you were trying to test them. Sometimes I noticed that you asked, "Could you go back on that and repeat it for us slowly."

Jack: Just to explain a couple of those diseases again. I found that, you see, they've put it in their speech, blah, blah, blah, but when I came back and said, "But do you understand it?", you could see that, like S said, "Well, Parkinson's disease, it's a disease, but it's a ..." and she hesitated. She just sort of stuck it in there but she didn't quite understand it. Whereas if you asked L to explain it, she gladly went back to the chart and did, and so did BG actually. He said, "I could go over those ones again." And he said, "This one is this one."Then he knew. You see he was nervous at first but I double tested him on that so that's why I made his mark a little higher than it would have been because I realised that he understood.

Int: So you're marking them on that kind of thing?

Jack: I also feel not only should it be presented well but they've got to understand it a bit.

Jess: And I would tend to say (that) this is something they have to get through and they have to handle. And so I'm thinking probably more on style than Jack is. I probably would let, be more concerned that they...

Jack: But you see, the next time I do this, if I were to do this again in future years, I won't get so bogged down, you know what I mean? The first time you do something everything is kind of bombarded at you. Once you do it the second time, you don't worry about certain parts of it.

Jess: For instance, on all that material on the brain, I mean I probably will use the words "cerebrum" on the test and I will probably, I might use "myelin sheath" because they mentioned it so often and probably "axon" or "dendrite" or something. (To herself) What else might I use?

Int: J said, "anox". Is that J, the dark haired one?

Jess: The dark haired one, he said "anox" instead of "axon". He has a language, spelling problem. But didn't you hear JA say that here's no relationship between "my nerve " and "J's nerve"?

Int: Yes.

Jess: Because he didn't agree with J. He'd obviously talked with him about this